January 1981 $2.00

•• Sneak Preview!!! The NEC PC-8001 Personal Computer ••

Personal Computing

For Your Home and Business

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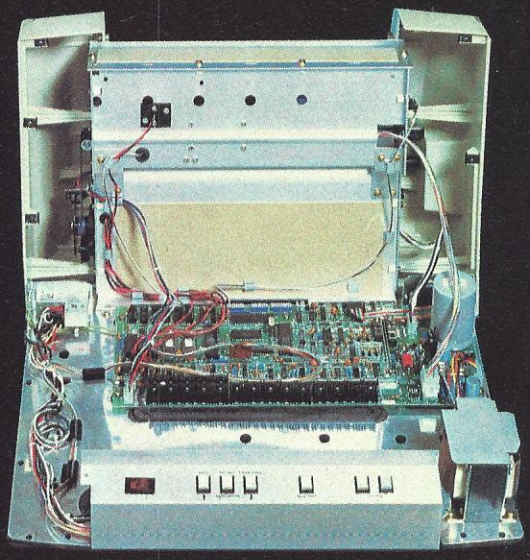

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CIRCLE 23

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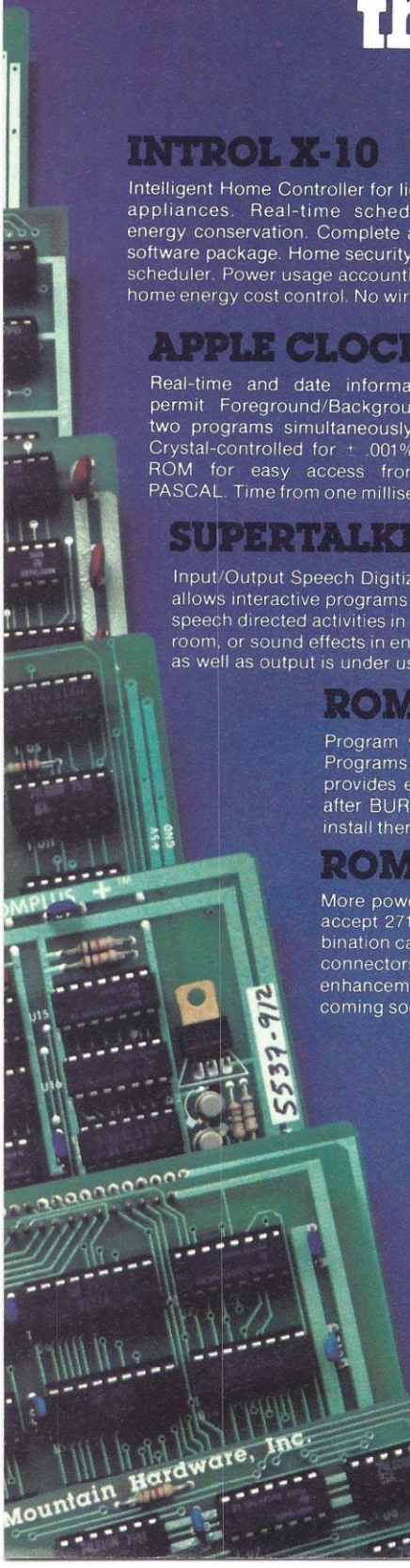

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CIRCLE 3

JANUARY 1981 VOL. V, NO. 1

Personal Computing

For Your Home and Business

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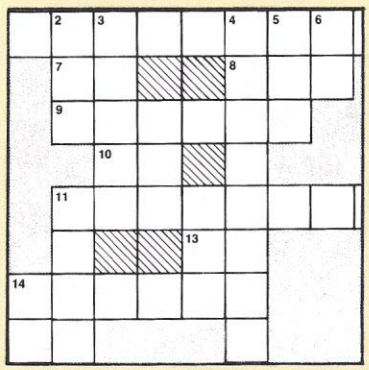

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DEPARTMENTS

SPECIAL REPORTS

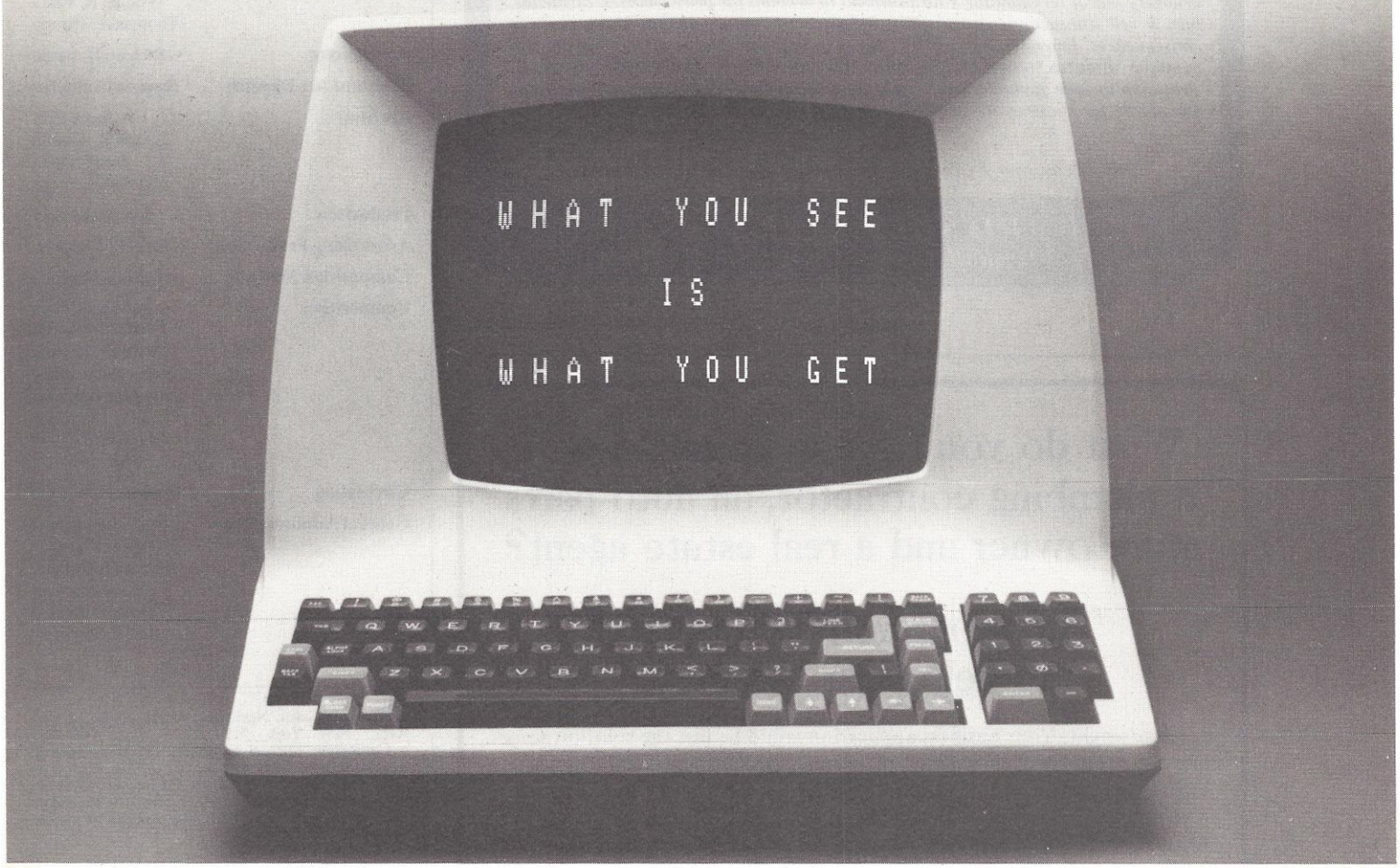
FEATURES

Cover Illustration by Josh Randall

35,943 copies of this issue printed

Publication Number ISSN 0192-5490

Can your software pass this screen test?



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Personal Computing

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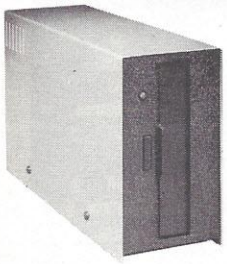

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FOR TRS-80*

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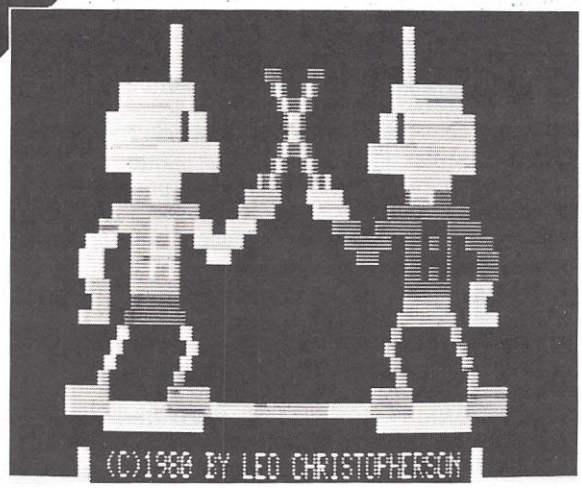

by Leo Christopherson

Your 'droid has already learned NIM, so now it's time to teach it how to wield a laser sword! Leo Christopherson, author of "Android NIM," "Dancing Demon" and other animations, has developed a new type of animation and high-quality sound in this, his latest work.

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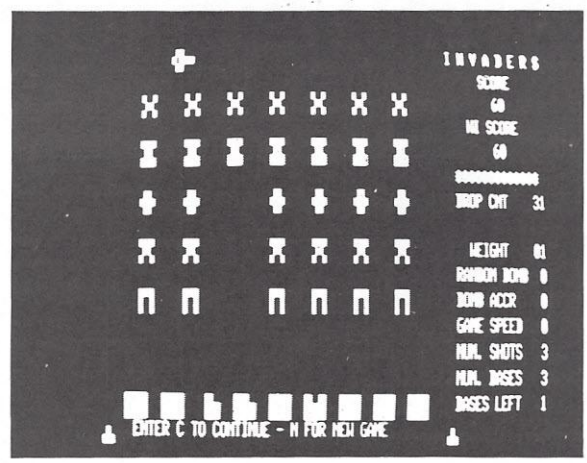

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by Carl Miller

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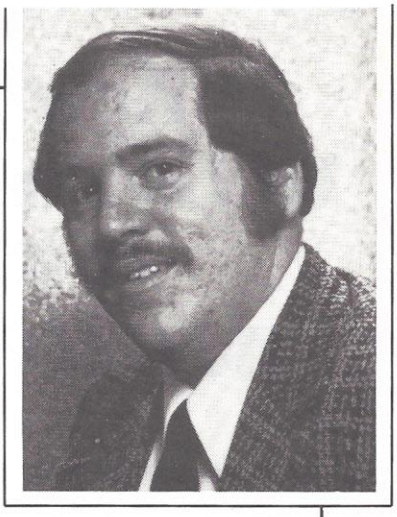
CIRCLE 8

EDITORIAL



CHANGES IN THE WIND

As many of you who have read the December issue are aware, *Personal Computing* magazine has changed hands and is now a member of the Hayden family of publications. Along with the change in ownership, come the inevitable changes in the magazine and its staff. You're looking at one of the first of these changes, the editorial page, and a message from the new editor of the magazine.

All future issues of *Personal Computing* will have an editorial, usually written by me, where I will keep you posted on some of the latest developments that are relevant to the owners and users of personal computers. It's my way of speaking directly to you. There is also a way that you can speak directly to me; through our Feedback column. This is where you have an opportunity to tell me how much you liked (or disliked!) an article, editorial or program that appeared in the magazine. I'd also like you to write to me and let me know what you think of the changes that will be appearing in the magazine in the next few months, and tell me what other changes you'd like to see.

We at *Personal Computing* are working hard on new plans to bring you more interesting, exciting and useful articles covering both software and hardware. In addition, we will have more evaluations and special reports to help you make better decisions when purchasing.

For those of you who like to write, we'd like to encourage you to send your manuscripts, program listings and sample runs to our New Jersey address listed on page 4. For those of you with good ideas who don't know how to put them down on paper, we will shortly be putting together a writer's guide that will help you get organized and show you how simple writing can really be.

I look forward to hearing from you and making *Personal Computing* the only magazine you'll ever need for news and useful and interesting articles in the personal computing field.

Jules H. Gilder
Editor

Now NRI takes you inside the world's most popular microcomputer to train you at home as the new breed of computer specialist!

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It's no longer enough to be just a programmer or a technician. With microcomputers moving into the fabric of our lives (over 200,000 of the TRS-80™ alone have been sold), interdisciplinary skills are demanded. And NRI can prepare you with the first course of its kind, covering the complete world of the microcomputer.

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CIRCLE 9

FEEDBACK

The Right Manufacturers

Dear Editor:

As the manufacturer of the popular Micromodem II for Apple II and Bell & Howell personal computers, we read your modem article in the October 1980 issue with great interest. Imagine our shock to find our Micromodem II listed in the vendor guide on page 64 as a product of the Apple Computer, Inc.!

Please let it be clearly understood by your readers that the Micromodem II is not and never has been marketed or manufactured by the Apple Computer Company.

Thank you!

Dana Perkins
Hayes Microcomputer Products
Norcross, GA

Fixing Free-Form Storage

Dear Editor:

It was pointed out to me that there is a line missing in the listing of my "Free-Form Storage and Retrieval System" article in your November 1980 issue. The line goes after 1110 in the Sort program and should read:

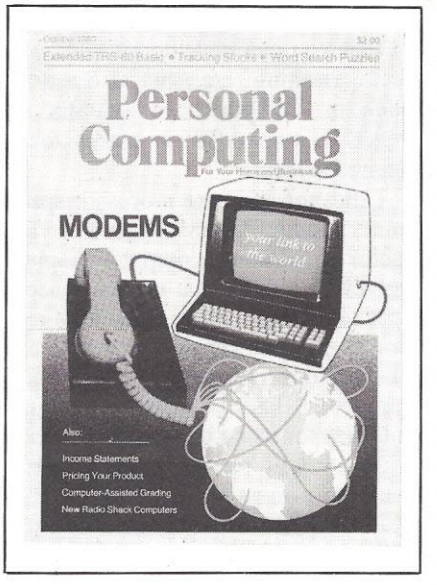
1115 NEXT

While this error will not cause trouble with casual use, if the information is recorded on the disk many times in one session, random errors will occur.

Also, the Auto-Write program will replace non-variable text in certain instances. For example, assume a form letter contained the variable STATE and later on referred to TEXAS. Also assume that the list of states is:

ALASKA
TEXAS
NEW YORK

The first two letters will be correct. However, in the third letter, the reference to TEXAS will be replaced with a reference to NEW YORK in both places.



The solution is to code the inserted NEW YORK with an unprintable character. Since all printers are different, experimentation will be necessary to determine which characters are unprintable. Assume that CHR$(130) is completely ignored by the printer. In this case, adding the following lines will solve the problem:

```
625L$(K1,I)=L$(K1,I)+
  CHR$(130)
825L$(K1,I)=LEFT$(L$(K1,I),
  LEN(L$(K1,I))-1)
```

William Lappen
Los Angeles, CA 90024

OSI Color Graphics

Dear Editor:

Your contributor undervalues the capabilities of the OSI C4 when it comes to color graphics ("A Look At Color Graphics," June 1980). Indeed, the C4 does not possess dot-addressable (so-called 'high resolution') graphics and suffers a little from the lack of graphics commands in Basic. It does, however, offer a number of pluses which don't appear to be brought out very successfully in the article.

First, we can consider the C4 graphics as being similar in conception to Lores graphics on the Apple II. The screen can display 64 characters per line, by 32 lines, and each point on this matrix may be occupied by any one of the 255 on-board alphanumeric and graphics characters. Indeed, color graphics — in fact any characters which are required to be placed on-screen at any point other than the scrolling line at the base of the screen must be POKEd into position. The display, however, does enable you to define background and foreground colors for each character position, from a repertoire of sixteen colors. In fact, three memory bits per location are associated with the color combination (RGB) and a fourth determines which color is foreground and which background. RGB combinations, of course, give you eight colors if each color is either on or off. The other eight are derived by cutting the luminance of the color signal by a certain percentage, under software control of the fourth bit. This inverts the B&W signal, which is used to bias the video output stage off to a certain degree. Thus, at each character location, you have a choice of eight colors for the character, the background being a darker variant of the same hue, or vice versa, depending on the setting of the fourth bit.

A character may be chosen — either a space (all background) or a certain graphic in which all the square is 'on' (all foreground) — which will enable you to plot color squares anywhere on screen in all 16 colors, not dissimilar to Apple's Lores, but lacking the specialized Basic plotting commands. However, something the C4 offers and Apple does not is the fact that you can place text and graphics anywhere you like, not simply four lines of text under a limited graphics area. This is very useful. Simulations of Apple's PLOT commands can be easily based around DEF functions in Basic, and as the character screen-memory and the color memory are separate, this can lead to very impressive functions, including flashing color graphics and text, and simple routines to set the entire screen to a color. Once you've defined the routines in DEF statements, the commands to plot on screen are a little more long-winded than on the Apple, although they're a little more complex

to understand (you have to think in memory locations rather than coordinates — but then you can define coordinates if you wish, and place the origin anywhere).

Another point is that OSI's Basic is exceptionally fast: C4s use a 2MHz clock in addition (with a 4MHz option) which makes an already fast Basic even more amazing. Even at 1MHz, as on the earlier C2, you can write an acceptably fast Basic 'Alien Invaders' or 'Brickout' game without recourse to machine code. This is simply impossible on most other machines, including the Apple II.

In brief, then, contrary to the opinion of your contributor, good real-time Basic color graphics are quite feasible on the OSI C4. It's a bit more trouble than on the Apple, and you don't have any form of 'Hires' graphic capability unless you count the 255 standard graphics (which, as you have pointed out, don't offer dot-addressing), but then it's about half the price of an Apple, too. And in 'Lores' mode, you get better definition. In fact, for the vast majority of applications, serious and otherwise, the 255 graphics characters are more than sufficient for effective displays. It's just graphs that are a little problematical, and here, if you are going to need dot-addressable graphics, you have to pay for it . . .or wait for a hi-res card for the C4!

Richard Elen
OSI UK User Group
London, England

Author's note: Perhaps fairness in rating a personal computer's color graphics capabilities is in the eye of the beholder or owner. Of course, I feel that I did not undervalue the OSI in my comparison. Mr. Elen seems to concede that the OSI does not have true, high resolution graphics and that it "suffers a little" from not having Basic language commands to do graphics programming. I am not sure that having only 8 colors and being able to switch foreground and background luminance for them is quite the virtue that he thinks it is. In low resolution, I would prefer to have 16 different colors.

It is true that I neglected to mention that you can mix graphics and text with the OSI. This can be done on the TI too. The fact that the OSI has separate character and color memory areas is a plus in that you can develop interesting effects (flashing, etc.) but also a drawback in that you have to PEEK and POKE in two different places to get desired effects.

I did not compare processor speeds in my article. Processor speed can be a factor in personal computer graphics; however, I think that the existence or absence of true, multi-color high resolution graphics capability and the ease of graphics programming — that is support in Basic or assembly language routines for using the graphics capabilities — will be far more important factors for most people. I did point out that the OSI has a very nice character set with useful gaming symbols and that, at least for most people, price was indeed another important factor in comparing current personal computer color graphics offerings.
— *Tracy Licklider*

Telidon

Dear Sir:

I enjoyed David MacQuarrie's article on "Telidon" in your September 1980 issue. The article does however leave out a number of details which would be of interest to your readers, most of whom I would imagine have more than a basic knowledge of computers. As presented in the article, the system appears as little different from the networks now in operation (The Source in the U.S.A., Prestel in Britain and the French system whose name escapes me at the moment). The major limitation on all these systems is that they operate on a byte-per-character basis and are consequently very slow, a great deal of redundant data must be sent and high resolution graphics are virtually out of the question.

The revolutionary difference in Telidon is that most of the work is done by a highly intelligent receiving terminal. For example a one byte code meaning Polygon tells the terminal that the next sets of X,Y co-ordinates should be joined to make a polygon (anything from a pentagon to a map of Newfoundland). This establishes an outline. The next code might be the FILL code, followed by modifiers for colour and pattern taking some two bytes in all. To draw a pentagon and cross-hatch it in any colour will take about nine bytes as against up to several hundred in the conventional systems. If you are using the telephone lines at 300 baud the advantages are obvious. This is only a small part of the many technical innovations in Telidon. Perhaps you could show some examples of the spectacular Telidon graphics in a future issue?

John Farrer
British Columbia
Canada

Any Suggestions?

Dear Sir:

We have several Northstar Horizon Computers with Intertube III CRTs that we use for educational purposes. Our problem is that we need some way for up to 50 students to view what is happening on the CRT screen as the instructor works with the computer during class.

Do any of your readers know of any way this could be done? Thank you for your assistance.

J.B. Orris, Ph.D.
Associate Professor
Butler University
College of Business Administration
Indianapolis, IN 46208

Textwriter

Gentlemen:

Page 37 of the September 1980 issue (in Jack Purdum's article) refers to Dr. Michale Posehn's Textwriter. I would appreciate more information about this.

Marin Berman
Teaneck, NJ

Author's note: I received a number of letters requesting more information about Allen Ashley's compiler and also Dr. Michael Posehn's Textwriter. It should be noted that Textwriter has been expanded to include many new features and is marketed by Organic Software under its new name of Text-

writer III. What sets Textwriter apart from many other text formatting programs is its ability to insert text from a disk data file into the middle of a text. You can, for example, write a form letter for a mailing and have the individual's name and address inserted into the form letter at the proper places in the body of the letter. It also does a beautiful job of printing tables of contents, indexes and footnotes that makes it perfect for those who write manuals, books and the like. The price of Textwriter III is $125. Persons wanting more information should write to the various dealers that distribute Textwriter III or directly to Organic Software, 1492 Windsor Way, Livermore, CA, 94550, or call (415) 455-4034. *— Jack Purdum, Ph.D.*

Adapting Gradebook for One Disk Drive

Dear Editor:

I am writing in reference to the article, "A Gradebook for Teacher," found on page 53 of the August 1980 issue.

The program is written in Applesoft Basic with 48K RAM, an Applesoft firmware card and two disk drives.

I am new to computers and have Apple II Basic interger with Applesoft Basic on tape, 48K RAM and one disk drive. Can the above program be used with the hardware I have?

John H. Emmons
Canton, OH

Author's note: You can make the program adaptable to a one disk drive system merely by changing the value of the string variable D2$ from ",D2" to ",D1". The rest of the program sections will operate smoothly.

Incidentally, the updated version is for sale from the Institute for Educational Research, 793 North Main Street, Glen Ellyn, Illinois 60137, for $39.95. *—Eric Geoffrey Vann*

October Feedback

Dear Sirs:

Robert Aden, in his Feedback article (October 1980), provided a very useful utility for those of us who push stock market data around a lot. To spend time laboriously entering reams of data requires such measures to cut into the waste — and more. One man I know listens to Books-on-Tape while entering the Dow Jones Industrial Average data (hourly) back as far as it goes!

I do have one change for Mr. Aden's program to prevent it getting hung up in some applications because many Basic dialects do not like jumping out of loops. Mine will do it once, but the second time I get FOR WITHOUT NEXT ERROR.

To solve the problem, simply replace line 1010 with Z = Z + 1, replace line 1120 with GOTO 1010, and change line 1080 to read NEXT Q: IF Z = 3 THEN Z = 0: RETURN

Now, if you wish to change the number of items that are entered at a time, simply change the 3 in line 1080 to whatever you wish. The RETURN will only be executed when the IF is true.

John R. McGinley, Jr.
New York, NY

Music Modifications

Dear Editor:

This letter is in regards to the article "Music to Soothe the Savage TRS-80" by Hugo T. Jackson which appeared on page 66 of your September 1980 issue. The article was an outstanding example of innovative programming.

The listing did contain one typographical error which makes it impossible to reload an existing music tape: line 13150 should read GOSUB 1000 vice GOSUB 1500.

The only complaint that I have with the program is that it does not make efficient use of the PRINT#-1 and INPUT#-1 commands. As written, the program uses enormous amounts of time and tape to record the information for even a short song. See Figure 1 for modifications to correct this problem.

The above changes will cause the saving process to proceed 10 times faster and take 10 times less tape. These times could be changed to 20 by changing references to "10" to "20" in lines 12565, 12570, 13095, 13140 and changing "9" to "19" in lines 12575 and 13095.

D.D. Dodgen
Portsmouth, NH

Figure 1

```
ADD      12565 PRINT#-1, INT(C2/10)+1
CHANGE   12570 FOR J = 1 TO C2 STEP 10
ADD      12575 FOR I = 0 TO 9: AX = AX + A6(J+I) :NEXT I
CHANGE   12580 PRINT#-1, AX
ADD      12585 AX = ""
CHANGE   12590 NEXT J
DELETE   12600
DELETE   12610
CHANGE   13070 INPUT#-1, C2
ADD      13075 FOR I = 1 TO C2
CHANGE   13090 INPUT#-1, AX
ADD      13095 FOR J = 0 TO 9:PRINT@750," ";:A6((I*10)-9+J) =
              MID$(AX,((J+1)*5-4),5):PRINT@750,"*";:NEXT J
CHANGE   13110 AX = ""
CHANGE   13120 NEXT I
DELETE   13130
CHANGE   13140 FOR C3 = 1 TO C2*10
ADD      13145 IF A6(C3) = "" THEN 13200
CHANGE   13150 GOSUB 1000
```

Victor Andrews and Soft Sector Marketing, Inc.

It is time to put your word processing program away and use a word processing system

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Takes on Scriptset® By Radio Shack® and Electric Pencil©®

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Easy to use, written all in machine code.

HAS ALL THE THINGS THAT OTHER WORD PROCESSING PROGRAMS SHOULD HAVE

● It permits the inserting and deleting by characters, word, sentences, and paragraphs ● Page scrolling up and down ● Search ahead of the cursor or behind the cursor for any character ● The cursor can be moved up, down, left and right ● You can seek top of file and bottom of file ● Block move of text, block delete of text ● Search and replace or search delete ● Delete by character, word, sentence or paragraph ● Unlimited insert (to the limit of your machines memory) ● Permits use with lower case

AND IT HAS THINGS THAT OTHER PROGRAMS SHOULD HAVE BUT DON'T

Upper and lower case output to your printer (if your printer accepts lower case) without having your computer modified.

ON UPPER CASE ONLY MACHINES: This program marks the capital letters so you can see which letters are CAPITALS and which are not.

● Will change all upper characters text to lower case or all lower case to upper, A SINGLE COMMAND ● Will capitalize the first letter of all sentences and all proper noun I's, WITH A SINGLE COMMAND ● LOADS ANY ELECTRIC PENCIL ● FILE, ASCII SAVED FILES, EDTASM FILES OR BASIC PROGRAMS SAVED ASCII ● Permits installing special control characters in your text for your printers special features, like double wide or condensed print ● Definable screen length and definable print length to 255 characters wide ● Screen editing that is not final till your command. This means that you can edit your file on the screen and if you don't like how it reads you can cancel and leave it the way it was. ● You can append files (which means that you can put one file to the end of another file) ● No lost characters at the end of the line even for the fastest typist ● A directory of all your files is available to the user with out leaving the program ● Saving programs to disk easy enough for the non-computer user ● To save memory, not all the program modules are in memory at one time but are called from the disk as needed. ● you can set tabs positions like on a typewriter ● 10 CUSTOM COMMAND KEYS For the experienced user there is a command file that permits many special functions that are all user defined (not enough space for better explanation in ad, send for complete overview) ● Program has HELP file that is a short review of the commands that are available

STANDARD PRINTER MODULE

This printer module is provided for the user as a standard feature. Optional special printer routines for custom printer will be available in the near future. In this original release, it has the following printer drivers and will support the following printing devices: RS232, TRS232 AND PARALLEL printer ports. You have the following format commands: Justifies Text, Centers Text, Centers Title, Line Spacing, Line Length from 3-255 characters and Set Margins ● Also send any ASCII code to any printer from the text.

● Save formated texted to the disk for spooling later ● Information for customer to load his own special printer driver ● Printing can be stopped and started by the user at any time and then restarted where you left off. ● You can print entire file or just print to bottom of the page.

COMMUNICATION PACKAGE

RS232 COMMUNICATION TERMINAL PROGRAM permits you to communicate with other computers. Transfer files from one machine to another. Permits dumping memory across the phone lines. Receive files from other TRS-80's and "Shake Hands" with larger computers. This is the complete system called LAZY WRITER. There is no package written for the TRS-80 that is as comprehensive. This package is available for the TRS-80 mod 1 32k or larger with at least a single disk drive. List price is from $125.95. For a more complete overview send a self addressed envelope.

DEALER INQUIRIES INVITED

SUPER-UTILITY

by K. WATT

SUPER-UTILITY was written by Kim Watt of Breeze Computing and is the most fantastic program of its kind to be available on the market at this time. SUPER-UTILITY is a machine language, stand alone program that has its own I/O routines and does not use any ROM or DOS calls. As a result, it should also operate on "CPM" machines and does not require that the disk be in any drive after initialization of the program. This program also supports the Radio Shack lower case modification, after initialization, SUPER-UTILITY occupies all memory from 4000H to 9FFFH. (That's 24K of machine code!!)

The zap utility is a program that does everything Apparats "SuperZap" does, plus many additional enhancements. The zap utility allows the user to go to the heart of the disk and read and/or modify data regardless of whether it is a protected disk or not. The screen printout on zap is similar to SuperZap, (one sector in HEX and ASCII) but also tells user the true and relative tracks and whether sector is IBM format or not. Zap also has a search routine that locates and displays the highest or lowest track on the disk and another that locates and displays the highest or lowest sector on a given track. In addition, zap allows user to single step track to track or sector to sector and even allows user to output to the printer. Zap has dual cursors (one for ASCII and one for HEX) that move simultaneously and allows that user to modify data using hex, decimal, or ASCII input, and any changes are automatically updated on both sides of the readout. Zap also allows user to display disk sectors, file sectors, copy disk sectors, compare disk sectors, or display/modify main memory. In addition you may search memory or the disk for a specified string and have its location returned.

Purge is a utility that allows user to kill files by filespec or have the computer list them one at a time for deletion. In addition, purge will also zero out unused directory entries or zero out unused disk sectors. You may also compute passwords on files. In addition, you can kill files by naming the category of the files (example: /CMD/BAS/TXT, (I) invisible, (V) visible, etc.) and also may change the disk name, date, passwords, protection levels. Purge also contains a complete disk directory that indicates all active and non-active files on the disk and their location in the directory, and the status of all granules on the disk.

Format is a utility that allows the user to format a disk with standard format, format WITHOUT ERASING existing data, or special format (custom format your disk any way you want it). This utility also allows the user to add tracks to any disk (example: change a 35 track disk to a 40).

The disk copy utility will copy any standard disk with or wit nout formatting. The special disk copy allows the user to make a backup of "ANY" (that's right I said ANY) TRS-80* readable disk that is presently on the market, regardless of any efforts that have been made to protect the disk from being backed up. NOTE: (the only exception is that it won't copy itself). This program's only intended use is for user to make backups of his/her legally purchased programs for his/her own use. Please do not use this utility to make "bootleg copies" for others as authors of quality programs deserve to be paid for their royalties!

The tape copy utility allows the user to make backups of "ANY" TRS-80* readable tapes currently on the market regardless of any protection attempts or baud rate.

The disk repair utility allows the user to automatically repair the HIT and GAT sectors if damaged and will also automatically repair a damaged BOOT. This utility does a complete directory check and will advise user of any errors. In addition this utility allows the user to recover killed files (if the file was killed by this utility or by NEWDOS) and user may read protect the directory. This utility also advises you of all files that are on the disk the location of each and which are presently active.

The memory utility allows user to move memory, jump to memory, test memory compare memory, zero memory, exchange memory, edit memory, load memory to/from disk, and input or output a byte to any port. Only $49.95 plus $2.50 shipping handling.

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CIRCLE 10

RANDOM ACCESS

Apple Computers Control Solar Home

Yesterday's house of the future exists today in Stamford, CT. The three bedroom, solar heated Sun/Tronic house, not yet completed, is run by two Apple II Plus computers which control many mechanical functions, including: energy maintenance, the security system, emergency lighting power, the fire and sprinkler system and smoke detector. Financial matters, games, entertainment and educational programs are also available for the occupants.

Copper Development Association, Inc., the house's developers, expect the concepts and technologies incorporated into the project to spark new ideas for future houses. "One of our design philosophies is that we try to work on the forefront of existing technology and combine some things within that framework that aren't necessarily done today but could be done," said Paul Anderson, vice president of Market Development at Copper Development. Although the company does not plan to duplicate the house, it anticipates other builders to incorporate some of the ideas used in the Sun/Tronic house.

One of the two Apples, located in the library, is programmed for the more serious aspects of the house's operation, such as energy control, monitoring of the security system and handling finances. The second computer, along with a 45-inch television set, is located in the family room and intended for entertainment and education.

Two remote terminals allow convenient access to the computer. A terminal in the kitchen retrieves receipes and menus, guest lists of previous parties, and wines stocked in the house wine cellar. A terminal in the master bedroom monitors the security lighting, temperature control, insulating shade system, and gathers stock market results and figures income tax. Both computers can be accessed from either of the terminal locations.

Several energy sources provide the house with heat and electricity. Sixty percent of the heat is supplied by liquid solar collectors and other solar systems. Also, a photovoltaic array mounted in the backyard converts sunlight directly into electricity. With a photovoltaic array, "the heat of the sun is transferred into direct current and that current is used to charge a battery array," explained Anderson. This system was initiated during the space program and has since become commercial for powering equipment in remote locations.

Three power pumps are associated with the liquid solar collectors. "These pumps bring in the heated water to a thousand

In the living room, a 14-foot-high energy column with an intake grill at the top, captures solar heated air thrown up by the two-story greenhouse.

gallon storage tank which supplies the home's hot water. The photovoltaic device array charges up the batteries which are tied back into the pumps. The pumps actually run off the battery," said Anderson. In emergency situations, there are a certain number of lights that would run off the battery rather than the solar pump. Two wood fireplaces provide back-up heat in emergencies.

The computers will read the battery array's charge; when the charge is satisfactory the battery will power the pumps.

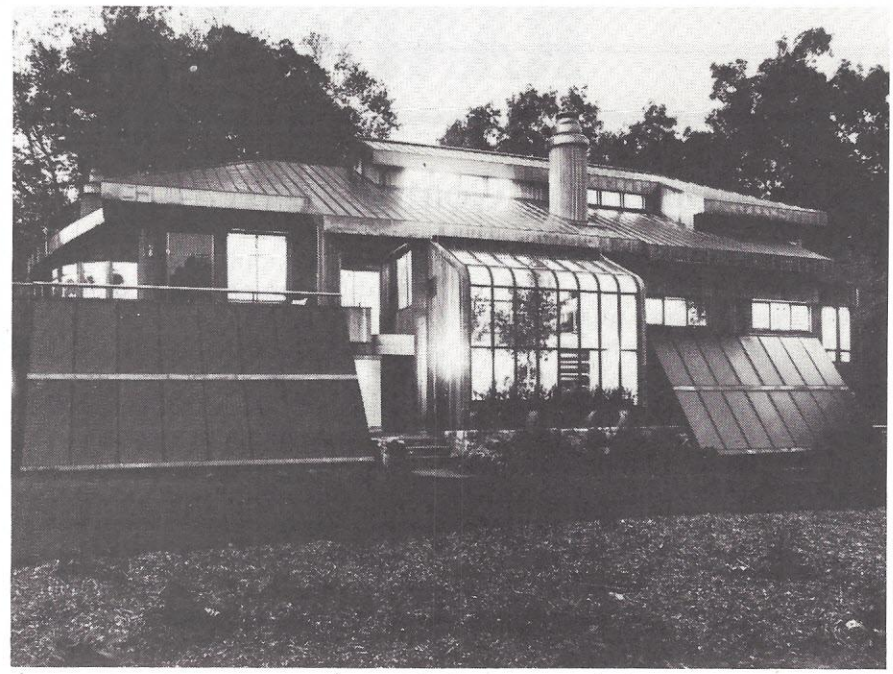
Based on preset parameters and weather conditions, the computer will be programmed to sense which energy system to use — solar energy or the heat pumps, said Anderson.

"The heat pumps are more efficient with certain conditions, primarily when outside air is on the warm side," said Anderson. "They take the heat from outside and put it inside. As the temperature outside drops, they become less efficient and at a certain crossover point the house would utilize solar power and not the heat pump. This point might be on a sunny day in the winter when the air outside is between 35 and 40 degrees. We'd use heat pumps, but as the sun set and the temperature dropped down, we'd switch over to solar." The solar pump would have been operating at a good capacity all day, heating water in the tank.

Copper Development plans to have a retired couple live in the Sun/Tronic house as managers. Although interested individuals within the industry are welcome to visit by appointment, the house will not be open to the public.

For more information, contact Estes Jones, Copper Development Association, Inc., 405 Lexington Ave., New York, NY 10174.

by Marjorie J. Morse



This night view of the rear or energy-producing side of the Sun/Tropic house emphasizes the greenhouse/solarium (center), and reveals, inside to the right, one of the home's passive copper solar water walls that absorb, store, and radiate solar heat when needed without mechanical assistance. On either side of the greenhouse are all-copper solar collectors that supply more than 60% of the home's space heating and domestic hot water needs.

Word Processing Effective in Single Lawyer Office

We expect a lot from the professionals who serve us and it's only natural that these professionals seek tools to enhance their talents and improve their effectiveness. For many, this challenge is being made easier and more attainable through the use of their own microcomputers and word processing software.

Walter A. Robbins, an attorney in San Rafael, CA, found his microcomputer not only helped improve the quality of his work but also reduced his cost of doing business. Handling cases concerning construction law, real estate and business, Robbins' workload requires an extensive amount of correspondence, forms and contracts. Like many sole proprietorships and small partnership service firms, Robbins originally enlisted the assistance of a typing service that also offered word processing.

He's convinced that within the last year owning his own microcomputer word processor has given him increased flexibility and convenience. At the same time, it has improved his business organization, client service, correspondence and the general atmosphere of professionalism.

Given the choice of word processing service or straight typing from his secretarial service, Robbins had done most of his small letters and other work by typing and reserved the more costly word processing for rather long and standard contracts. As time went on, Robbins found the extra cost for word processing service was more than justified in the time it saved.

"With the straight typing, I might have to wait two days for a letter to be done, have to send it back for corrections and then get it back 'corrected' with other errors," relates Robbins. "While the word processing service made

corrections faster, monthly charges went up considerably as I transferred more of my workload to this method."

Eventually, Robbins reasoned that since he knew how to type, and his spelling and punctuation knowledge was good, his best option was to get his own word processing system.

A word processing typewriter was first recommended because special function keys made it less confusing to operate. "I found that using a word processor typewriter was simpler only because there was less you could do with it," laments Robbins.

Another problem Robbins noted with the typewriter word processors was the lack of adequate viewing capability. With only a partial line shown at a time with some systems, he found it difficult to improve page formatting and other editing functions.

For the most flexibility and capability, Robbins put together a system consisting of a Vector Graphics computer, NEC printer and WordStar word processing software from MicroPro International.

WordStar is an integrated microcomputer word processing system featuring on-screen formatting, powerful editing commands, printer enhancements and an extensive list of available text functions. Following WordStar's series of on-screen help menus, Robbins learned the majority of text editing activities within the first two weeks. Soon he was performing a number of operations never before available to him, even with conventional word processing.

Owning his own microcomputer word processing system has also given Robbins some unexpected advantages when it comes to preparing cases, saving clients' time and money, increasing the effectiveness of his reports and documents and making contract development more convenient.

Flexibility while preparing for cases is probably the most appreciated WordStar feature used by Robbins. While thinking of questions for a witness, composing a deposition summary or outlining legal issues with references, Robbins enters information as it occurs to him. Later, he uses WordStar's block move feature to place these randomly developed thoughts into a logical sequence which the jury can more easiiy follow.

"These operations would be difficult to do in long-hand, and just couldn't be done with a cassette," relates Robbins. "The best way to be well organized before a court appearance is to compose your thoughts with a flexible and powerful word processor system."

Quick and efficient response to client needs is another ability afforded Robbins with his WordStar word processing system. In cases where delicate communications concern both legal and situational issues (for example, a Declaration Under Oath) speed and tact are equally important.

After working with a client to determine and identify relevant points, they may feel uncomfortable with extensive legal terminology. Robbins can use WordStar to make changes while the client has another cup of coffee.

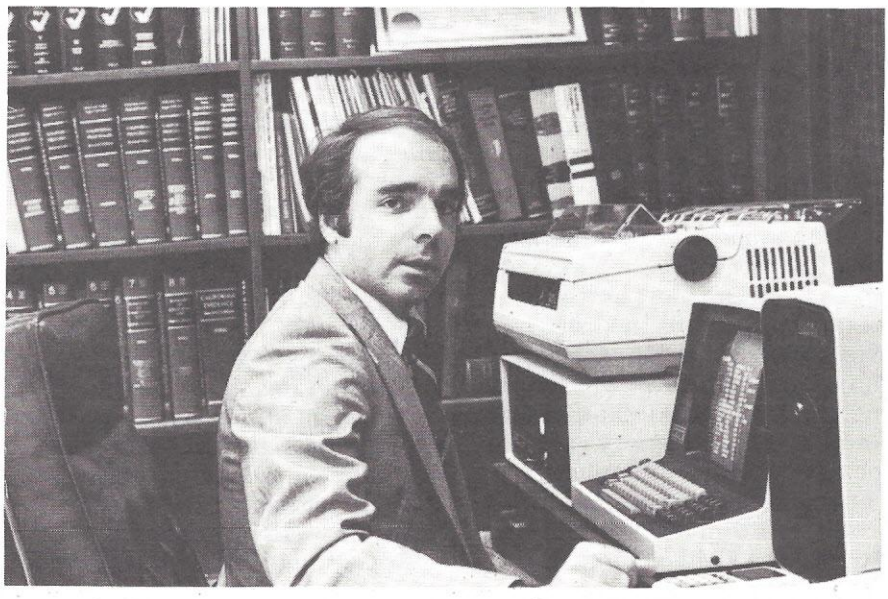
Robbins has found presentations of briefs to the court can be improved using WordStar's extensive printer enhancements. He uses WordStar's boldface capabilities to draw attention to specific areas with authority. "It looks good and stands out, and I'm sure it helps get points of particular emphasis across in a more meaningful, effective manner than simply putting them in italics," believes Robbins.

Recent laws affecting forms to be used by contractors and real estate transactions have also made bold printing a major asset to Robbins.

"WordStar gives me the advantage of not making my clients go out and buy all new letterhead or unprofessional 'fill-in-the-blank' type forms," explains Robbins. "For the 'Notice to the Owner' section of contracts, I also change the character width and boldface to produce a strong impact."

Contracts, formerly a major headache for Robbins, are now prepared in a phenomenally short period of time. Each can be pulled together very quickly from "boiler-plate" information with the system's files and combined to make a single, perfectly spaced and formatted document.

Keeping track of phone conversations for billing purposes is another innovative use Robbins has found for his word processing system.



Attorney Walter Robbins with his office system.

sees to it that his sales staff of nine is on a continuous training program.

"Product knowledge is something we continually strive for," Hamid emphasizes. "For instance, if Atari brings out a special edition of their popular home computer system, we don't learn how to properly operate the system by thumbing through an owner's manual. We learn to operate the system directly from the manufacturer by having an Atari-trained technician work with my staff and myself until we know as much about the unit and its capabilities as they do."

To be represented in Future Tronics, a new stock item must meet three basic requirements. The new item being considered must be electronic in nature, must have the reliability of a top name brand standing behind it, and must be the "cream of the crop" of its particular line.

With Future Tronics' prices ranging from $10 to $8000, Eslami hopes to provide something for everyone. Whether a curious browser, a child learning to spell, a student learning math, a sports fan playing 3-dimensional basketball, an amateur astrologer, or simply someone who realizes that imagination holds the key to the future — Futures Tronics should have something for all.

Advanced Voice Response System Developed

Not too long ago, Texas Instruments caught the imagination of the personal computing industry by coming out with an inexpensive speech synthesis accessory for its TI 99/4 computer. Well, it looks like they're about to do it again. While TI has not announced the availability of any computer accessories yet, they have announced the development of an advanced voice response system capable of converting English text (presented as ASCII characters) into understandable speech.

Unlike TI's earlier development that had a vocabulary limited to words stored in the system's ROM's this system has a virtually unlimited vocabulary. According to Dr. Kun Shan Lin, a speech research and development manager for TI's Consumer Products Group, TI linguists have chosen 128 separate sounds, called allophones, and produced a system that can link them together to sound out almost any word in the English language.

Allophones are variations of something known as a phoneme, which is the smallest unit of speech that can distinguish one utterance from another. These allophones require 3K of memory and are stored as a look-up table. Another 7K of memory contains the rules by which allophones can be connected together to produce information that can be fed into the TMS 5100 speech synthesizer chip.

Because English is such a complex language, speech scientists have found it impossible to achieve 100 percent accuracy in converting text to speech, but according to Dr. Lin, the new TI, is 92% accurate.

Interfacing to the system is easy. It is accessible through the Basic computer language, and will sound out any message typed on the console keyboard of a minicomputer or microcomputer such as the TI-99/4 home computer.

Computer Portraits: A Growing Business

In shopping malls across the country, people are having realistic portraits produced for a few dollars in less than 60 seconds. This would have been impossible a few years ago, but thanks to today's minicomputer and line printer technology, computer portrait printing represents a rapidly growing business.

In computer portrait printing, a compact system that consists of a minicomputer, closed-circuit TV camera, and a line printer generates a detailed portrait of the subject, which can be a person or a photograph. Portraits then can be framed or transferred to T-shirts, posters and many other items. The entire procedure can be completed in just a few minutes.

"The computer portrait printing business did not become a commercial reality until the mid-70's ," says Jim Swartz, President of the Cygnus Group, an association of independent businessmen involved with computer portrait printing. "Soon after that," he says, "we developed the first low-cost, truly portable, computer portrait system." Since then, the eight member-partners in the Cygnus Group have been enjoying steadily increasing sales. Despite this, group members were not satisfied with the line printers they were using, and as a result, recently began using General Electric TermiNet 200 printers. "Before our switch to GE printers," says Swartz, "we had been experiencing many reliability problems with output devices. In fact, about 90% of our system down time was being caused by malfunctioning printers.

After extensive testing and evaluation, the Cygnus Group selected the TermiNet 200 line printer as the standard printer for all new Cygnus I Systems. "Portrait printing is an extremely grueling application and we were looking for a printer that was durable enough to take this kind of punishment over a long period of time."

The "brain" of the Cygnus I

System is a minicomputer featuring a built-in keyboard and video monitor. The minicomputer and its software are produced by Kokomo-based Hard-Line Instruments. Other major system components are the TermiNet 200 printer; a closed-circuit television camera with zoom and portrait lenses and a tripod; a 19-inch TV monitor; heat transfer press; lighting equipment; and electrical cables and connections. Total cost of a complete Cygnus I System, Swartz indicates, is less than $15,000, with no franchise fees required. In addition to the hardware, this price includes operator training anywhere in the continental U.S.

Swartz believes the computer portrait printing business will enjoy excellent growth. "Computer portraits make a lasting souvenir and it's fun to watch them being made. Most people are fascinated by computers and enjoy seeing themselves on a TV screen," he indicates. All this helps explain why computer portrait printing systems attract so much attention at shopping centers, department stores, trade show exhibits, conventions, fairs, amusements parks, flea markets and other high-traffic areas.

Independent operators can transport their Cygnus I Systems easily in a full-size car. The system can be set up in about 30 minutes and a two-person team can print several hundred portraits in a single day. Cygnus I Systems are marketed throughout the U.S.

Computer Home Banking

Electronic home banking is a reality in Knoxville, Tennessee. Now, consumers can use the services of their local bank with a computer at home.

The "Express Information" bank-at-home service is a joint venture of United American Service Corporation (USAC), Radio Shack and CompuServe. The United American Bank in Knoxville was selected as the first bank to use and market the service to its customers.

For a price of $15 to $25 a month, 400 of the bank's customers will gain services of Radio Shack's new TRS-80 Color Computer, including a standard keyboard which plugs into the customer's own television set and telephone. Customers will have access to a comprehensive news and financial advisory service, will be able to pay most of their bills, receive current information on their checking accounts, use a sophisticated bookkeeping service, and apply for loans. This opens a new dimension in convenience banking.

These services are being offered to customers in eastern Tennessee. "We are releasing these programmed services in phases to allow our customers adequate opportunities to familiarize themselves with in-home computer use," said Thomas E. Sudman, UASC President. "As their expertise and needs increase, the sophistication of the information services increase."

The first phase includes a news and information network developed by CompuServe of Columbus, Ohio. CompuServe President Jeff Wilkins says customers can choose information from a list of national, international and financial news, including the latest stock quotation and commodities information. United American Bank will add their own bank news and daily information on savings and deposit rates to this system.

The remaining phases include two-way communications with the bank for bill paying, bookkeeping, tax services, and electronic mail, giving customers the opportunity to communicate to each other through the system.

Customers of the bank are issued a security pack and certificates which can be redeemed at any of the 6,000 Radio Shack outlets nationwide. Without directly purchasing the computer, customers will be able to use it for a number of other functions: entertainment, education, home security, message services and electronic filing.

Records of dates, number, name, client billed, time called and length of call are all maintained under the file "Phone". When Robbins needs to talk to someone he can retrieve the number and log the entire procedure in a single step.

At the end of the month, Robbins uses WordStar's search and replace capabilities to look up the occurances of phone calls to be billed to specific clients, and then activates WordStar's file transfer facilities to quickly prepare a professional bill with full documentation of his work.

Correspondence through Robbins' office has also been substantially improved. "If I get something in the mail, I like to turn around and type a reply which goes out immediately," said Robbins. "Rather than dictate, I can automatically see if there is something that I want to change, move around, delete, add or whatever. Of course, I could do all this if I had my own secretary, but that would take more time and money."

Robbins also likes having more control over the look and length of his correspondence. Whenever a letter turns out to have two or three extra lines on the next page (as indicated by WordStar's dynamic page display), he can choose to change the margin spacing, line height, or space width and immediately reformat the letter. "In five or ten seconds I can very conveniently move everything up on the same page," he noted.

Expandable up to five work stations, Robbins expects any potential associates to also use the WordStar word processing system, but with the help of a secretary.

"I would like to have each attorney use their own terminal, compose their own work, and then have a secretary/typist go through and edit, correct punctuation and spelling, clean up the page formatting and generally improve the appearance and accuracy of the document," explains Robbins.

As far as other law practices go, Robbins thinks that most large practices have word processing already and that the vast majority of small practitioners have been under the false impression that this capability is unavailable at a cost-effective price. His entire system cost approximately $8500. He estimates it will pay for itself in savings from secretarial services in two to three years.

"Computers can be bought for anywhere between $5000 and $25,000," said Robbins. "But WordStar word processing software gives even the less expensive system enough power to substantially improve office efficiency and effectiveness."

According to Robbins, further proliferation of word processing systems is just a matter of time and education. "I think all attorneys will at least have systems like mine within the next couple of years," he predicts.

Fire Fighting Efficiency

The rigorous environment of fire fighting presents a tremendous challenge to fire protection agencies. Recognizing the responsibility involved, Motorola Inc., has designed and produced a microcomputer system that helps maximize efficient use of the the first critical minutes of a fire.

Motorola's technological resource provided the expertise to develop this microprocessor based system. In addition, Motorola research teams conducted comprehensive studies to probe every aspect of emergency handling that deals with saving lives and property. As a result, the FDP-100 Dispatch and Communications System enables fire departments to tailor response procedures based upon their specific resources and requirements. These procedures can be stored and retrieved when needed. Motorola's FDP-100 also enables the dispatcher to maintain status of all equipment and personnel at all times.

Management status reports, operating procedures and resource control of equipment are just a few of the capabilities of Motorola's FDP-100.

With the touch of a finger, the dispatcher can enter and display up to fifteen active fire, rescue or EMS alarms. In addition, as many as ten alarm response levels with up to fifteen pieces of equipment can be recommended for each situation. When an alarm is closed, the hard-copy printer automatically provides a complete and detailed record.

In apparatus equipped with Motorola's Status/Message units, the FDP-100 can add to its efficiency by establishing communications between firemen and dispatcher through the use of digital messages which are automatically sent and displayed.

Although Motorola's system is based on advanced technology, an important feature is how simply and quickly equipment becomes operational. Costly additional training time is eliminated due to hands-on training. This provides practical experience for new dispatchers while they're learning. Since all operating information is "protected," it cannot be modified or destroyed.

Basic system hardware consists of a preprogrammed microcomputer, CRT display terminal with keyboard, logging printer and dual floppy disk.

Highly accurate communications and dispatching systems are necessary at all times in order to serve a community effectively. Errors in interpreting complicated messages can be minimized

with Motorola's Mobile Printer Support option.

Hard copy messages are sent to both vehicles and fire stations. Repeated transmissions are also reduced. Memory errors are avoided and firefighters can direct greater concentration to controlling fires and/or other emergencies.

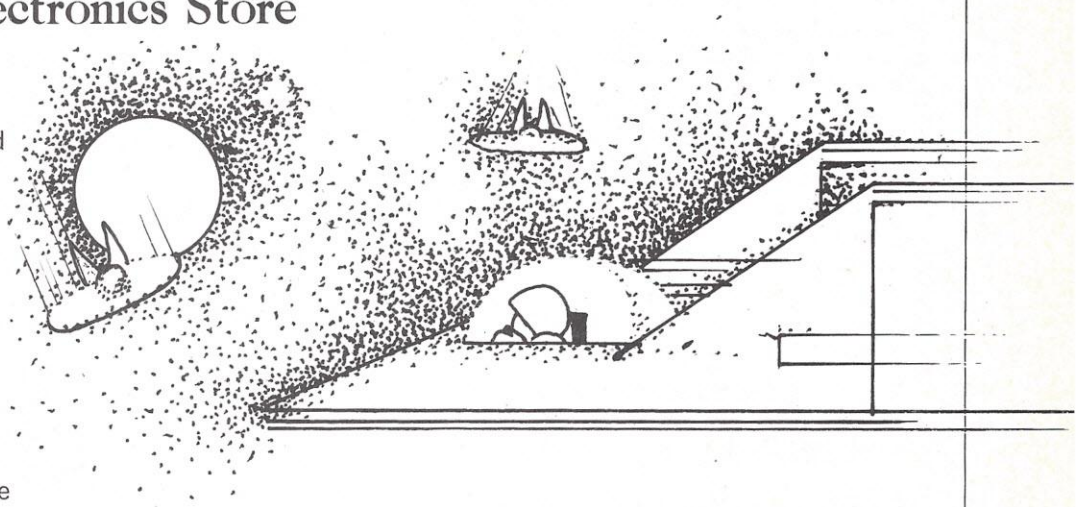
Many times incorrect information from the person reporting an incident hinders prompt response from firefighters. Motorola has developed the Street Address File to verify validity of all incident addresses. This file is built to include cross streets also. Additionally, it has the capability of providing premise information to the firefighters on the scene.

The Address File also proves beneficial in identifying the exact location of an activated wire alarm. When the alarm number is entered into the system, the FDP-100 automatically displays the alarm address and recommends units to be sent to the scene. Valuable time is saved due to the elimination of a dispatcher's manual search to interpret the alarm meaning.

The FDP-100 system is in operation in Howard County, Maryland, Lees Summit, Missouri, Jefferson Parish, Louisiana and Las Vegas, Nevada.

For additional information contact Pat Schod, Motorola Inc., Communications Group, Public Relations Dept., 1301 E. Algonquin Road, Schaumburg, IL 60196.

Unconventional Electronics Store



Nestled within fashionable Westwood Village, CA, Future Tronics is a veritable playground for the gadget-loving kid in everyone. An extensive product line includes more than 700 different items. For the casual observer to the hard core electronics aficionado, it's all here: chess sets that talk, micro home entertainment centers complete with AM/FM stereo receiver, amplifier and tape deck, clocks that speak, games that spell and teach math to children under the clever guise of entertaining them, watches that double as calculators and calculators that double as clocks.

For the modern executive on the go there are ink pens that are fine digital time pieces, and micro cassette recorders no larger than a deck of playing cards — perfect for on-the-spot dictation and note taking. For those planning to travel abroad there are hand-held translators that convert up to 2000 words and 152 basic sentences into French, German, Spanish or Italian.

Future Tronics also sells the latest in communication equipment for the home. There are machines that record/repeat/playback and hold messages that can be heard from any telephone in the world. There are cordless telephones with a range of 300 to 500 feet, and phones that automatically dial up to sixty pre-set numbers, which, if the number desired is busy, will continue to dial that number every sixty seconds for ten minutes.

Future Tronics offers an assortment of home computer systems designed for a variety of functions, from teaching a person to type while accurately measuring how many words per minute are typed, to realistically simulating space battles that put the customer in the cockpit of an intergalactic star fighter, chasing down hordes of marauding enemy warships.

Opened in June 1980, Future Tronics is the brain child of Mr. Hamid Eslami. The store features a relaxed atmosphere that encourages customers to look, touch, play, browse and investigate the multiude of in-house gadgets to their hearts content.

Future Tronics is an arcade for the mind, a treat for the senses and a haven for hassle-free shopping. Customers only buy something when they want to, never because some high pressure salesman has forced them to. As Eslami says, "When I go into a store I feel uncomfortable if an overly-anxious salesman is breathing down my neck. You won't find that happening at Future Tronics. I'm not happy here unless the customer feels at home."

In keeping with this no-hassle policy, the Future Tronics sales team keeps to the sidelines, allowing the products to "speak" for themselves, yet assisting when necessary.

☆☆☆ Announcements ☆☆☆

Computerized Office Expos

Three regional business expositions will be held during 1981 by the Cahners Exposition Group. Stressing office automation and efficient business systems, the expos include exhibitions and seminar programs. The three Computerized Office Equipment Expos will be held as follows:

Rosemont, IL (suburban Chicago); O'Hare Exposition Center; April 7-9

Houston, TX; Astrohall; October 20-22

Atlanta, GA; Civic Center; November 17-19

For more info, contact Cahners Exposition Group, 331 Madison Ave., New York, NY 10017; (212) 682-4802; or Industrial & Scientific Conference Management, Inc., 222 West Adams Street, Chicago, IL 60606; (312) 263-4866.

ComputerTown, USA!

ComputerTown, USA!, a computer literacy project of People's Computer Company, has been awarded a National Science Foundation grant.

The project, using the resources of the Menlo Park (CA) Public Library, community centers and local business locations, donated hardware and software, and volunteers, brings hands-on participation in microcomputing to the city's children and adults.

In the next three years, ComputerTown, USA! will continue to publish and distribute its monthly bulletin, offer an expanded set of courses, workshops and events, document the project in the form of a descriptive model and distribute information to other communities around the country. ComputerTown, USA! is being offered as a model of a computer literacy undertaking that can be implemented anywhere using local resources and talent, PCC said.

The project is directed by Ramon Zamora. Offices are at People's Computer Company, a non-profit educational corporation, P.O. Box E, Menlo Park, CA 94025; (415) 323-3111.

Investor News

The MicroComputer Investors Association has several commercial software packages available for test and evaluation by members, with the results to be reported in the association's newsletter. Interested members should contact the association's Director of Software Testing and Evaluation, Robert Greenwald, at 10358 Lombardi Dr., Ellicott City, MD 21043; (301) 461-2204.

Tim Pugh is Communications Project Coordinator. He will coordinate a core of members who will begin transferring programs and data over telephone lines. Interested members who have an acoustic modem and 8-inch drives operating under Digital Research's CP/M should contact Tim at 9655-M Homestead Ct., Laurel, MD 20810; (301) 776-5253.

For more information on the non-profit MCIA, send $3 for an information packet to Jack M. Williams, The MicroComputer Investors Association, 902 Anderson Drive, Fredericksburg, VA 22401.

Bally Arcade User Group

The Cursor Group, a manufacturer-supported user group for the Bally Arcade, supports over 40 affiliated local user groups (with over 8000 members) and establishes new user groups on a regular basis.

The group informs members of the computer's many commands and routines available, such as Peek, Poke, floating point decimal math, machine language bootstrap, 3-voice music, five or more colors on screen at the same time, DMA graphics, voice recognition, adding a full-sized ASCII keyboard and printer, etc.

Members gain access to nine separate manuals which decode the secrets of the Bally Arcade, including electrical specifications of custom chips, executive software descriptions and so forth. The group also publishes a monthly newsletter containing software and programming hints along with tutorials and hardware projects.

Membership fees range from $9.75 for six months to $18.95 for one year. A sample newsletter can be purchased for $2.

For more information, contact, The Cursor Group, P.O. Box 266, North Hollywood, CA 91603.

Sinclair Users Magazine

Sync, a bi-monthly magazine for users of Sinclair ZX80 and MicroAce computers, debuts in early 1981. Sync will carry applications such as financial analysis, statistics, simulations and games. The charter issue offers program listings for Acey Ducey (a card game), Hurkle (in which the player has to find a Hurkle hiding on a 10 X 10 grid) and the Nicomachus "boomerang" puzzle.

SYNC also provides in-depth, objective reviews of software, peripherals and books related to the ZX80 and MicroAce, the publishers said.

Subscriptions cost $10 per year (6 issues). Send payment to Sync, 39 E. Hanover Ave., Morris Plains, NJ 07950.

Do you have an unusual application? Write up a short article for us. See p. 4 for our address.

CIRCLE 11

What Will Computing Be in Fifty Years?

BY WILLIAM R. PARKS

At the beginning of each year, some magazines and newspapers carry predictions of what the future will bring to their subscribers. Therefore, I thought it would be appropriate to include in this issue, a list of predictions which I have made for the years 2030 and 2080. This list is also included in a stainless steel time capsule to be opened in Dunkirk, New York, containing artifacts of 1980 to pass along to the citizens of Dunkirk 50 and 100 years from now.

The following is taken from the package of materials I included in Dunkirk's time capsule. I hope readers in the years 2030 and 2080 accept these predictions with a certain amount of humor. Obviously, 50 or 100 years is much too far in the future to make any kind of accurate or precise predictions and I may be underestimating our future society's technological capabilities. However, I thought you might want to read them 50 years sooner than I intended them to be read.

Professor Parks is in the Department of Mathematics and Computer Science at Fredonia State University College, Fredonia, NY.

Predictions on Computing in the Years 2030 and 2080

- In today's America nearly every household has at least one television set. In fifty years, almost every home will have a computer system which will be even more powerful than the most advanced computer we have today.

- Nearly every appliance will have an intelligent component processor that can hear and speak. Some families will own mobile robots that can speak as well as listen to commands.

- The huge television industry we have today, serving the general public in producing programs viewed by hundreds of millions of people, will be an even larger industry employing countless computer programmers in the production of mass media interactive programmed events in the year 2030.

- Fifty years from now, all banking and mail will be done directly from a computer terminal in the home. A kind of paperless society will result and 20 percent of the population will work at home, communicating to their places of business via their computer terminals.

- The same chips that manipulate data will also be able to store many volumes of books. Some of the programs and data will be so complicated that it will take many years of training to fully utilize such a system. For example, there will be one chip especially for doctors (reference programs and data for medical professions) or a machinist's chip (all necessary programs and graphics displays to operate as a machinist). Computers will also be a very important subject in the schools.

- The problem of unemployment will be solved by distributing the workload. Every citizen will work a fewer number of hours per week because of automation. Programmers, however, will work at home as many hours per week as they like and computer programming will be the most open field of employment.

- A project to make computers virtually human-like will succeed. The obvious dangers to society will be overcome by a liberally educated society that will see the differences between man, the human, and simulated man, the computer-robot. Man will be in control and children will be taught to distinguish between artificial intelligence and human intuition. The power of the computer will nevertheless make some think that certain robots are "alive" and some computer personalities will be as famous as Hollywood stars are today.

- The 1970's and 1980's will be looked upon as the important beginnings of miniaturized computer technology at low cost. Perhaps, in the future complex society, computer-robots will sell for the same price automobiles sell for today. The robot industry will become as important as the auto and steel industries and just as nearly every household has a car today, it will also have a computer-robot.

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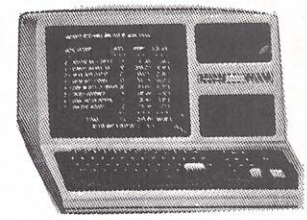

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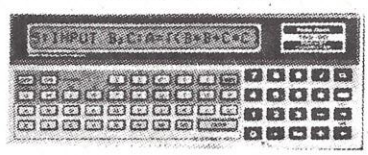

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CIRCLE 12

Word Processing Software Roundup

BY STEVEN JONG

If you're interested in word processing — for your thesis, office work, typing service, or that magazine article — you should know that you can spend less than $50, or more than $500, for a software package. You can even invest in turnkey systems, costing thousands of dollars, that do nothing but word processing. What should you look for? Can you afford the features of word processors you've seen on television? How much hardware will you have to add? Here, nineteen software products are described and compared in detail.

What Can WP Do for You?

Let's look at a familiar, tedious typing job — a term paper. Your text must be broken into pages, indented four ways (from the left, right, top and bottom edges of the paper) and double spaced. Some passages (long quotations, for instance) are single spaced, and further indented left and right. At each new paragraph, you must check to see if there's enough space left on the page to start it, skip a line, and indent the first word. In a bibliography, you want to indent the left margin for text, but violate it with numbers. (In word processing parlance, this is "negative indenting," or "undenting.")

Within the body of the text you must underscore titles, center lines, format equations with superscripts and subscripts, prepare footnotes, reserve space for illustrations and compose tables. You must number each page and put your name, and perhaps other information as well, at the head or foot of each page (a typesetter would call them "running headers and footers").

This kind of drudgery is very common, and you may have resigned yourself to doing it by hand. For every mistake you haul out the correction fluid; for every misspelled word you change one or more pages; for every edited paragraph you retype a whole page. And the final result always looks faintly wilted from all your attentions.

Word processing stands ready to relieve you of every one of these chores. When you enter new text, it handles almost all formatting automatically. Furthermore, it positively shines when you have to edit your document; the more you edit, the more you'll appreciate WP. In short, word processing can improve both the speed and the quality of your work.

What You Need to Start

Word processing software is usually delivered on diskette, and for fastest operation, you ought to have at least one diskette drive. Your terminal should generate both uppercase and lowercase characters (since you're working with documents, not programs). The larger the display, the better; 24 lines by 80 characters (24 × 80) is ideal. For most word processing products, the larger the available RAM, the larger the document you can edit.

Most word processors require an operating system under which they can run. One operating system of choice is Digital Research's CP/M, which runs on Intel 8080 and 8085 and Zilog Z80 microcomputers; another is Radio Shack's TRSDOS. A few processors, though, are complete systems unto themselves, and require no suporting software.

The most significant requirement is the printer. Most products can drive almost any printer, but letter-quality printers, as manufactured by Diablo, Qume, NEC, and others, produce the best results. You must decide beforehand on the quality of output you want, and whether you want to spend several thousand dollars on a letter-quality printer, before selecting your software. Finally, consider performance before making a selection. Inexpensive word processing packages are often written in BASIC, and are relatively slow and inefficient. Software written in assembly language, though it costs you more, is usually well worth the investment because of its superior speed and power.

Features to Look For

Before turning to specific products, let's examine word processing features that you should look for. They fall into three areas: entering and editing text, formatting, and driving the printer.

The single most important editing feature is word wrap or wraparound. While a regular text editor accepts your input without alteration, a word processing editor breaks your text as you enter it, into roughly equal lines. When the line you're typing reaches the right margin, the editor plucks the word violating the margin off the line and begins a new line with it. With this feature, you need never look up and compose lines. Carriage returns are entered only at the end of paragraphs (blocks).

Once the screen fills up with text, the editor can scroll off old text, or empty the whole screen and start you off fresh. As the file grows, disk buffering (the ability to manipulate a file larger than available RAM) comes in handy. If you're a fast typist, keyboard buffering is also important.

Line and Screen Editors

Two types of word processing editors are available today: "line" editors and "screen" or "character" editors. Line editors, incorporated into some low-cost packages,were developed for mainframe computers driving Teletype terminals. They operate on a single line or block of lines, in two modes called input and edit. In edit mode, your type-ins are interpreted as commands. In input mode, your type-ins are interpreted as text to be stored. For instance, in input mode the letter "d" is just text; in edit mode, "d" might mean "delete the current line." Most computer users have traditionally worked with line editors. These editors are difficult to use, because you often get confused as to which mode you're in, and because you only see changes line by

line. This makes line editors hard for beginners.

Screen editors, developed for video display terminals, are far simpler to use because they don't have modes and you always see your changes the instant you make them. For instance, to delete a character, you backspace and type over it. The offending character disappears from the screen — and your file. To enter a command, you press a prefix key (CTL, ESC, or some pacakage-specific key) which signals the editor that the next keystroke is a command. For instance, CTL/H might mean "send the cursor to the home screen position." With a screen editor, no matter what you're doing, CTL/H always does the same thing, and you can see it happen instantly.

With screen editors you navigate from point to point by moving the cursor up, down, left, or right. Word processing keyboards have cursor keypads, similar to numeric keypads. Software packages using standard keypads use mnemonic commands (U, D, L, and R, say) or adjacent keys (W for up, Z for down, A for left, and S for right — try it!). You can also home the cursor, scroll text up and down, jump to the next screenful of information, start at the top or bottom of the file, or search for a certain string of characters. As on a typewriter, you can quickly set and reset tabs. A few systems feature decimal tabbing — the ability to line up columns of figures on their decimal points.

All this gets you where you want to be within the file. Once you're there, screen editors let you insert and delete characters; the rest of the line flows left or right, possibly reforming the rest of the paragraph. You can insert and delete whole lines or entire blocks; the rest of your text is rearranged automatically. You can also search for, and replace, a character string, once, N times, or globally (throughout the file). Several products include an interactive search and replace, in which the editor shows you each occurrence of the string and asks your permission before replacing it. A few even allow approximate searches, in which "Cat," "CAT," and "c at" all turn up when you search for "cat."

Editors also allow block copying (repeating a specified passage somewhere else in the file), moving (transferring a passage from one point to another within the file), and merging (placing a block of text in several files). This last feature is sometimes sold separately because of its usefulness in preparing form letters.

Formatting Your Document

The text formatting portion of word processors works on commands which you embed in your text. The formatter's main task is producing paged output, enforcing left, right, top and bottom margins, and single- or multi-spacing lines. Formatters also justify text, by adding spaces to fill lines out precisely to the margin. Sometimes, though, you don't want text justified (as in a table). For those places you can turn justification off.

Some formatters can reserve a block of spaces (called a "keep block") which will never be split between pages. Formatting commands control underscoring, overstriking (placing one character over another like "b"), chaining files together for sequential processing and printing of large documents, and insertion of one file within another (useful for form letters, or to create and use your own formatting command "macro calls"). More sophisticated programs allow you to define running headers and/or footers: in some cases just the page number, sometimes one or more full lines of text to appear on each page, and sometimes alternating even-page/odd-page text. They also allow you to enter lines of non-printing text as comment lines. Finally, for that typeset look, some formatters allow multiple columns.

Printing, the Final Step

The last step is printing your document. Here the quality of your printer — and your software's ability to drive it — is critical. Letter-quality printers can:

- Microspace, inserting fractions of spaces between words to fill lines without noticeable gaps;
- Roll the paper up and down by half lines, giving you superscripts and subscripts;
- Print in boldface, by striking each boldface character twice, the second time slightly displaced;
- Overstrike, printing any two characters on top of each other;
- Print bi-directionally (one line forward, the next backward from the end), to save time and print element motion;
- Shift the ribbon between black and red, for two-color printing.

Even if you don't have a letter-quality printer, you can still enjoy some benefits from using word processing software. Most of the programs can print on both continuous-feed and single-sheet (letterhead) paper. They can interrupt printing and prompt you to take some action. They can also prompt you to enter a line of text, which will appear in the finished document, from the keyboard. And, for maximum efficiency, some allow simultaneous printing and editing on the same machine.

Getting Down to Cases

Now that we've seen the features of a typical word processor, let's compare some of the packages available today on a feature-by-feature basis. Table 1 lists the programs by price, with formatter-only programs (see inset) listed last. Unless noted otherwise, all editors are screen editors. Most packages run under CP/M or Radio Shack's TRSDOS. Table 2 lists editing features; Table 3 lists formatting features; and Table 4 lists printer features.

The Word Processing Program is a low-cost WP package operating on Commodore Pet systems. The program, written in BASIC, is available on cassette only. It includes a line editor which therefore lacks cursor control features and is somewhat cumbersome to use. The Word Processing Program operates on files up to 250 lines long, with a limited search/replace capacity and features for moving blocks of text. The version for 16K and 32K Pet systems allows upper- and lowercase letters, diskette storage of text, block copying and disk buffering. The larger version can also justify text or print it ragged left, chain and insert files, and break pages on command.

Radio Shack's Scripsit, distributed on cassette for TRS systems, has unusual features for a micro-based system. Its editor allows both vertical and horizontal scrolling; swapping of adjacent words and blocks; and an interactive search/replace. The formatter includes "semi-automatic" hyphenation: after the system formats a document (but before justifying it), it goes back and looks for words extending into a "hot zone" near the margin, and allows you to decide whether or not to hyphenate those words. The formatter also suppresses widow (single word) lines at page ends, allows full control over the four page margins and the page length, allows running and alternating headers and footers, and gives you your choice of justified, flush left, or flush right text. The package comes with an audio training course on cassette.

The Apple Writer, designed for Apple II systems, comes on two diskettes, and includes an interactive, on-line tutorial program. It operates on files up to twelve pages long on its 24 x 40 screen; because the unmodified Apple can't display

Table 2
Editing Features

	Word Processing Program	APPLE WRITER	SUPER-TEXT	Easy Writer	SCRIPSIT	Pie/Format	PRO-TYPE	Electric Pencil II	Wordsmith	WpDaisy	WORD-STAR
CURSOR MOVEMENT:											
Up, down, left, right		■	■	■	■	■		■	■	■	■
Character		■	■	■	■	■	■	■	■	■	■
Word		■					■	1	2	■	■
Line	■	■		■	■	■	■	■	■	■	■
Block	■	■							3	■	
Page		■	■						■	■	
Scroll		■	■	■	■	■		■			■
INSERT:											
Character	■	■	■	■	■	■	■	■	■	■	■
Line	■	■	■	■		■	■	■	■	■	■
Block	■	■	■	■		■	■	■	■	■	■
DELETE:											
Character	■	■	■	■	■	■	■	■	■	■	■
Word	■	■	■	■	■		■	1		■	■
Line	■	10	■		■	■	■	■	■	■	■
Block	■	■	■			■		■	4	5	■
SEARCH/REPLACE:											
Once	■	■	■		■	■	■	■	■	■	■
N times		■			■		■	■	■	■	■
Globally		■	■		■	■	■		■	■	■
Query first		■	■					■		■	■
BLOCK OPERATIONS:											
Copy	6	■	■		■	■	■		■	■	■
Move	■	■		■	■	■	■		■	■	■
Merge	■		■		■	■	■			■	■
ONSCREEN FORMAT:											
Change margins	■	■			■		■		■	■	■
Center	■	■			■				■	■	■
Underline	■						■		■	■	
Multiple windows		■	■						■		
STATUS LINE			■			■	■	7	■	7	8
ONLINE HELP					9					■	■
DISK BUFFERING	6								■		■

NOTES:

1. TRSDOS version only
2. 1- or 8-character jumps
3. Move by page/window
4. Insert/delete by page/window
5. Delete block/page
6. 16/32K versions only
7. Status screen
8. Status window
9. Interactive tutorial included
10. Delete sentence

Table 3
Formatting Features

	Word Processing Program	APPLE WRITER	SUPER-TEXT	EasyWriter	SCRIPSIT	Pie/Format	PRO-TYPE	Electric Pencil II	Wordsmith	WpDaisy	WORD-STAR
LINE ADJUST:											
Justify	1	■	■	■	■	■	■	■	■	■	■
Ragged right	■	■	■	■	■	■	■		■	■	■
Ragged left	1				■						
LINE SPACING:											
Single or double	■	■	■	■	■	■	■	■	■	■	■
Triple or multiple	■	■		■	■	■	■	■		■	■
SET PAGE IMAGE:											
Left margin	■	■	■	■	■	■	■	■	■	■	■
Right margin	■	■	■	■	■	■	■	■	■	■	■
Top margin		■	■		■	■			■	■	■
Bottom margin		■	■		■	■			■	■	■
Page length	■	■	■	■	■	■	■	■	■	■	■
Reset margins		■	■			■	■		■	■	■
"Undent"				■		■				■	■
TABS:											
Set/reset	1	■	■	■		■	■		■	4	■
Decimal			■								■
RUNNING TEXT:											
Headers		■			■	■		■	■	■	■
Footers						■			■	■	■
Page numbers		■		■	■	■	■	2	■	■	■
Alternating even/odd		■	■								■
FILE CONTROL:											
Chain files	1		■	■	■	■	■			■	■
Insert files	1	■	■			■	■			■	■
MISCELLANEOUS:											
Center (command)	■	■	■	■	■	■		■	■	■	■
Underline (command)			■			■	■	■	■	■	■
Multiple columns								■	■		
Keep block	■					■			3	■	■
Comment Lines		■	■		■			■		■	■
Break page	1	■	■	■	■	■	■	■	■	■	■

NOTES:

1. 16/32K versions only
2. TRSDOS version only
3. Unnecessary — whole page visible
4. Also supports negative (back) tabs

Table 4
Printer Features

	Word Processing Program	APPLE WRITER	SUPER-TEXT	Easy Writer	SCRIPSIT	Pie/Format	PRO-TYPE	Electric Pencil II	Wordsmith	WpDaisy	WORD-STAR
PRINT AND EDIT	■				■		■		1	■	
SINGLE-SHEET FEED	■	■	■	■	■	■		■	■	■	
OPERATOR PAUSE/PROMPT	■			■		■			■	■	
ON APPROPRIATE PRINTER:											
Boldface	■		■	■			■	■	■	■	
Overstrike	■						■	■	■	■	
Super/subscript			■	■					■	■	
Microspacing				■				■	■	■	
Bidirectional printing					■			■	■	■	
Red ribbon shift			■						■	■	

NOTES:

1. I/OS version only

Table 5
Formatting Program Features

	WORD-4	TPS	TEX	TFS	TEXTWRITER III	TEXTFORMER
LINE ADJUST:						
Justify	■	■	■	■	■	■
Ragged right	■	■	■	■	■	■
Ragged left		■				
LINE SPACING:						
Single or double	■	■	■	■	■	■
Triple or multiple	■	■	■	■	■	■
SET PAGE IMAGE:						
Left margin	■	■	■	■	■	■
Right margin	■	■	■	■	■	■
Top margin		■	■	■	■	
Bottom margin			■	■	■	
Page length	■	■	■	■	■	■
Reset margins	■	■	■	■	■	■
"Undent"		■	■	■		■
RUNNING TEXT:						
Headers	■	■	■	■	■	■
Footers		■	■	■	■	■
Page numbers	■	■	■	■	■	■
Alternating even/odd		■		■	■	
FILE CONTROL:						
Chain files	■	■		■	■	■
Insert files	■	■		■	■	■
MISCELLANEOUS:						
Center	■	■	■	■	■	■
Underline		■		■	■	■
Footnotes		■			■	
Multiple columns		■				
Keep block	■	■	■		■	
Comment lines	■	■	■	■	■	
Break page	■	■	■	■	■	■
Paragraphing		■	■	■		
PRINTER FEATURES:						
Single-sheet feed	■		■	■	■	■
Operator pause/prompt	1	■			■	
Boldface	2				■	
Overstrike	2			■	■	■
Super/subscript	2			■	■	
Microspacing					■	
Red ribbon shift	2				■	■

NOTES:

1. With one-line code modification
2. By transmitting ASCII control characters

lowercase letters, the package displays uppercase letters in inverse video. To erase characters within a line, you press the left arrow key; until you enter RETURN (the editor can't wrap words), you can retrieve the deleted characters by pressing the right arrow key! The Apple Writer features block copying, moving and merging, and ragged right/left formatting.

The Muse Software Super-Text package, for Apple II or Apple II Plus systems, has two distinctive features. It includes a built-in 15-digit, four-function, floating-point calculator with scientific notation. The calculator lets you do automatic column totals within text. Also, the Autolink feature allows file chaining, across up to 12 drives, during both editing and printing. Muse recommends the separately available Dan Paymar lowercase kit to allow your Apple to do word processing in uppercase and lowercase characters. Cursor control commands let you send the cursor to the middle of the screen, the beginning or end of text, or to the last change made. Super-Text also has a one-key abbreviation for the often-used word "the." Its formatter allows both page numbering and chapter-relative page numbering.

Easy Writing

EasyWriter, by Information Unlimited Software, also operates on Apple II or Apple II Plus systems. It has probably the most ornate first screen in the businesss. EasyWriter represents uppercase characters using inverse video. For block operations, the block is always defined as extending from the beginning of the screen to the cursor. EasyWriter features an approximate (ignore case) search function.

In addition to the original EasyWriter word processor, Information Unlimited Software has just announced the availability of a new and improved version know as Easy-Writer-The Professional System. Of all the word processor programs available for the Apple, this one seems to be the best so far. Unlike the others, this is the only program available on the Apple that displays the text on the screen exactly the way it will appear on the printed page.

One disadvantage of this system, is that it is designed to work only with an Apple that is equipped with one of the 80-column display boards. Since these boards generally cost about $300 to $350, the cost of using this word processor could go over $500 if you don't already own one of these boards.

Both this version and the original are written in FORTH, and use a nonstandard disk operating system. This means that text files created by this program can only be stored on specially formatted diskettes and that it is not generally possible to use EasyWriter files with other word processors or programs. In addition, the disk is protected from copying so that it is not possible to make backup copies. To overcome buyer resistance to this, a backup copy of the main disk is included in the package. So at the very worst, if one disk ceases to work properly, it can be sent back for replacement while the other is used. Replacement disks cost $10 to registered owners.

Aside from these two objections, the program works quite well. There are several enhancements to this program over the original. Firstly, like Apple Writer, it contains a delete buffer so that if you accidentally delete too many characters, they can be retrieved by just entering CRTL-I, retrieving them one at a time. Another feature that has been added is horizontal scrolling so that it is possible to see more than 80 columns on the screen.

One of the most important features added to this program, which is not available in any other Apple word processor, is proportional spacing. This evenly distributes small spaces throughout the printed line so that a more professional looking document is produced. This version of EasyWriter also has something known as HMI (for Horizontal Motion Index). This is a fancy way of saying how much you want the printer to move between each character. With this feature, it is possible to change the pitch of the type and get 10 or 12 or other pitch type.

Up to three one-line titles can be placed on a page, which makes it possible to have headings, subtitles and footers.

Perhaps the best feature of this word processing program is its manual. It assumes you know nothing about word processors or computers and takes you through the set up and use of the program step by step. This is definitely one of the best manuals around.

A new word processor has just been introduced by Commodore for the CBM 8032, the 80-column version of the popular PET computer. Known as Wordcraft 80, this word processing program features variable page layouts with line widths as long as 117 characters and page lengths as much as 98 lines long.

Unlike most word processors for home computers, Wordcraft 80 displays the text on the screen as it will appear on the final document, so that it is very easy to set up columns and tabular data. This is a feature that is usually found only on professional dedicated word processing equipment. Other features of Wordcraft 80 that are not usually found in personal computer-based word processors are the ability to have alternate left- and right-sided page numbering (book style) and half-line paper advance control for subscripts and superscripts.

In addition to these unusual characteristics, Wordcraft 80 can also handle the following standard word processing functions:

1. Automatic centering
2. Right margin justification
3. Headers and footers
4. Character, word and paragraph insertion and deletion
5. Block movement of text from one page to another
6. Merging of standard blocks of text to form documents
7. Merging of letters with name and address files
8. Character string search and replace
9. Automatic underlining
10. Automatic boldfacing of text

As do many of the advanced developments from Commodore, this one comes from England, which explains (at least partially) why it is priced so high, at $395. This is certainly more than most U.S. word processing programs would cost, even comparable ones like the new Easy Writer Professional System. While as a stand-alone program it is expensive, Commodore is really pushing it as part of a complete hardware/software package which would sell for about $5000. This is a system that is capable of competing with $7000 to $13,000 dedicated word processors, and as such the $395 cost becomes less significant.

Apple PIE is a versatile word processing program with over 150 commands. While this large selection of commands gives the user a lot of flexibility, it also makes the program a little more difficult to learn. Once it is mastered, however, the large number of commands is appreciated.

Programma International sells its Apple PIE and FORMAT programs as a WP package. The editor features a 21 × 38 "window" into text which jumps left and right as the cursor moves. This allows you to see, after a fashion, 64-character lines on a 40-column display. In paragraph mode, PIE does word-wrapping. Unless you use the Dan Paymer Lowercase Adapter (recommended), you see only uppercase characters, with the right-arrow key functioning as the shift key. You can tab right and left; go to the top and bottom of a file, a

Text Formatting Programs

If you're already comfortable with your text editor, and just want letter-quality output with a minimum of fuss, then you should consider a text formatting program, designed to handle the formatting and printing aspects of WP. Adapted from mainframe programs, these formatters process your file based on default values and commands which you embed in your text.

The formatting programs listed in Table 5 run under an operating system and thus use whatever printer the operating system drives. (Of course, you'll want a letter-quality printer — and a program that can put it through its paces — for best results.)

Micro Architect's Word-4 was one of the first word processing programs available for TRS-80 systems. Written in BASIC, Word-4 runs slowly on Model I hardware; but Micro Architect's Tony Pow says that because it's delivered in source code, users can modify it to suit their own needs. For instance, changing one line of code implements an operator pause/prompt feature. (On Model II systems, it runs nicely.) The program produces both uppercase and lowercase characters without hardware modification. The .SC formatting command transmits ASCII characters, which gives you, with some effort, boldface, overstrike, superscripts and subscripts, and red ribbon shift on letter-quality printers.

The Text Processing System (TPS) by Technical Systems Consultants, Inc., is an impressive program with over fifty commands. It allows justified, ragged right and ragged left text; alternating even/odd page headers and footers; and page numbers in Roman, Arabic and lowercase Roman numerals! TPS lets you name a collection of formatting commands, and later call this "macro" collection repeatedly. TPS-supplied macro routines allow multi-column printing and footnotes, two tough challenges for any formatter. Along with this macro call feature are user-accessible registers storing the date, current page and column number, and current margins, and also conditional commands(execute if on even page, execute if given register equals N).

TEX, by Digital Research (creators of CP/M), is designed to work in conjunction with the ED text editor. It allows four-margin control, headers, footers, page numbers and paragraphing. You can set values absolutely, relatively, or to a default. The .in command, for instance, can mean:

- .in 10 — indent all text to column 11;
- .in +10 — indent all text 10 spaces more than before;
- .in −10 — indent all text 10 spaces less than before; or
- .in — reset left margin to the default (column 1)

TEX also includes powerful macro features.

Supersoft Associates' TFS is available in 8080 assembler source code for fast execution. With over fifty commands, TFS allows four-margin control, alternating headers and footers, page numbers, paragraphing and automatic list numbering. TFS also includes macro processing.

Textwriter III, by Organic Software, has just about everything you'd want in a formatter. Organic Software's Terry Kennedy says, "We're going to give Word-Star a run for its money"; based on its features, his product is worth boasting about. Besides offering four-margin control, footnotes, and full printer capabilities (boldface, superscripts and subscripts, microspacing, etc.), Textwriter III has single commands which send entries and their associated page numbers to a table of contents and alphabetized (!) index. Anyone who's ever had to reorganize a thesis will appreciate what this program can do.

Digitran Systems' Textformer includes commands to print overstruck characters and shift to red ribbon. The program allows you to enter loops for repeated formatting.

particular line, or a particular column; search forward and backward for a string; split and join lines; and copy or move up to a screen's worth of text. A special command allows you to append text to the end of lines (handy for annotating programs). You can also shift text columns left and right. The formatting program allows four-margin control, headers and footers, underlining and centering, and file chaining and inserting.

The system consists of two machine language programs, a text editor and a text formatter. While splitting these functions out as separate programs increases the amount of memory that can be dedicated to holding a text file, it does become a little inconvenient because when switching back and forth between the editor and the formatter, you have to wait until the appropriate program is loaded into memory from the disk. This also means that your disk with the word processing program on it must be in one of the drives all the time. Thus it is possible for the word processing programs to be accidentally destroyed. Programma has thoughtfully accounted for such a possibility by not protecting the disk and thus allowing the user to make back-up copies of the word processor disk.

In many respects, Apple PIE is a line-oriented editor. It is possible to go randomly to a particular line in the text file, or move, copy and/or delete specific lines. It also has the ability to split or join lines of text. Other features include, single, conditional and global replacement of character strings and automatic counting of lines or words. It also allows files to be pieced together from parts of other files.

One of the most useful features of the Apple PIE word processing system is that the manual very clearly and simply explains how to modify the keyboard on the Apple computer so that the normal shift keys can be used. Most Apple word processors use the ESC key for shifting letters. This one ordinarily uses the right-arrow key for shifting and also uses the shift key in modified machines. While some other word processors may also accommodate the shift-key modification, they don't all tell you how to implement it.

The system comes in a 7 × 9 -inch padded binder with roughly 200 pages of documentation, that thoroughly explains all of the features of the system. And, in case it is not all clear, a sample file is provided on the disk that shows you how many of the formatting commands are used. After reading over the documentation thoroughly once, in most

cases it will only be necessary for the user to refer to the handy foldout card that is included which summarizes all of the commands.

This word processing system is currently available for the Apple II computer in standard 40-column format as well as in any of the three popular 80-column formats. There is also a version available for computers which use the 6800 microprocessor, and a TRS-80 version is in the works.

Pro-Type is a line editor written in assembly language which allows you to work on documents up to twenty pages long. With its double text buffers, you can produce form letters easily; with its editing macros, you can repeat a command sequence as often as you want. Its formatter allows chaining and inserting of files, and it supports any printer the host operating system (CP/M, North Star, or Meca Alpha) can drive.

The Electric Pencil II is a very popular package for TRS-80 systems. It also runs under CP/M, IMDOS, and Helios. Its files aren't directly compatible with CP/M; a utility is needed to convert files between the two. The package normally works on a 15 × 62 screen, but a 24 × 80 version is available. The editor allows bi-directional, multi-speed scrolling and a query search/replace; a "scoreboard" screen tells you such information as the number of words and records currently in the file. However, the Pencil lacks keyboard buffering, so don't type too fast into it. It does, however, support multicolumn printing.

Wordsmith is a unique product. It requires a custom 39 × 86 (15″) screen, and is normally sold as a complete system (the software alone lists for $395). Wordsmith is a page editor; each screen of text represents a printed page, and its editor and formatter (written in 8080 microprocessor code) are designed around the concept of page manipulation. Wordsmith splits the screen into as many as twenty-four windows to accommodate your text. You can thus lay out the most complicated page formats effortlessly, cut and paste windows, restrict the action of editing commands to a window, and save page formats (called "archipelegoes") for later use. Wordsmith includes a one-page "hold buffer," allowing simplified page copying and moving. It can search for an approximate string; move, insert and delete windows and pages; and perform true multicolumn printing. The product also features disk buffering, so you can work on documents larger than available RAM, and bi-directional printing, for speedy output. This fascinating product may or may not meet your needs, but it clearly demonstrates the potential of micro-based word processing.

WpDaisy is a powerful software package operating under CP/M or its own operating system, I/OS. Like Wordsmith, it includes an interactive generation routine adapting it to a wide range of hardware. Its editing buffers (up to 26!) facilitate easy manipulation of text blocks. Editing features include movement by page, block and page deletion, a query and approximate search/replace function, and a tab ruler which lets you see the location of every tab stop (WpDaisy supports both front and back tabs). An on-line help feature reminds you of the function of any command at keystroke. The formatter allows "soft" hyphens, which you enter in words you think ought to be hyphenated. When the document is formatted, these words are hyphenated only if necessary; otherwise the hyphen is suppressed. WpDaisy can also undent, and breaks paragraphs with a single command. The I/OS operating system allows simultaneous printing and editing, and red ribbon shifts on printers so equipped.

MicroPro International's Word-Star is one of the most impressive word processors available for microcomputers today. Its menu-driven editor displays no less than four "help" levels, from a simple tabstop display to an eight-line menu which can direct you to information about each command. The window also displays commands currently under execution and other data. A powerful set of commands includes variable-speed scrolling, query search/replace, high-intensity and inverse video display of blocks being manipulated, decimal tabs and disk buffering. Word-Star does most of its formatting onscreen, including justification of text as you enter it! It also displays the end of each formatted page onscreen. Other formatting commands include undent, alternating even/odd page headers and footers, and file chaining and insertion. An installation program customizes the software to your hardware, allowing Word-Star to take full advantage of the capabilities of letter-quality printers. It can change character pitch and line spacing; print in overstrike, superscript and subscript; microspace; print bi-directionally; generate red ribbon shifts; and it can perform these functions in any combination. Best of all, Word-Star is easy for an inexperienced typist to use.

The Choice is Yours

Now that you've seen what's available, you should be able to shop knowledgeably for a product which meets your needs at a fair price. For the cost of a good printer plus a few hundred dollars, you can enjoy the word processing power once limited to businesses. Good hunting!

Vendor Guide

NAME	COMPANY	SYSTEM REQUIRED	PRICE	COMMENTS
Word Processing Program	Connecticut microComputer 150 Pocono Rd. Brookfield, CT 06804	Commodore PET 8-32K RAM CmC printer adapter RS-232 printer	$29.50/8K $39.50/16K	PET only; Line editor
SCRIPSIT	Radio Shack 1300 One Tandy Center Fort Worth, TX 76102	TRS-80 Level II 16-32K RAM Upper/Lowercase	$69.95/16K $99.95/32K	TRS-80 only; distributed on cassette
Apple Writer	Apple Computer Inc. 10260 Bandley Drive Cupertino, CA 95014	Apple II, 1 disk 48K RAM	$75	Apple only
SUPER-TEXT	Muse Software 7112 Darlington Drive Baltimore, MD 21234	Apple II, Apple II Plus, 48K RAM	$99.95	Apple only

NAME	COMPANY	SYSTEM REQUIRED	PRICE	COMMENTS
SUPER-TEXT II	Muse Software 7112 Darlington Drive Baltimore, MD 21234	Apple II, Apple II Plus, 48K RAM	$150	Apple only
EasyWriter	IUS (Information Unlimited Software 281 Arlington Ave. Berkeley, CA 94707	Apple II, Apple II Plus, 48K RAM	$99.95	Apple only
EasyWriter "The Professional System"	IUS (Information Unlimited) Software) 281 Arlington Ave. Berkley, CA 94707	Apple II, Apple II Plus, 1 disk, 80-column video card	$250.00	Apple only
PIE/FORMAT Release 2.0	Programma International Inc. 2908 No. Naomi St. Burbank, CA 91504	Apple II, 1 disk 32K RAM	$129.95	Apple 6800 systems
PRO-TYPE	Interactive Microware P. O. Box 771 State College, PA 16801	CP/M, North Star, or Meca Alpha OS 8K program size	$75	Line editor
Electric Pencil II	Michael Shrayer Software 1198 Los Robles Drive Palm Springs, CA 92262	CP/M, IMDOS HELIOS, or TRSDOS OS 16K RAM (TRS-80 Level I)	$300	CONVERT utility required for CP/M; $35
WORDSMITH Release 1.2	SCION Corporation 8455-D Tyco Road Vienna, VA 22180	CP/M or North Star Horizon OS 32K program size Screensplitter Video Module custom CRT	$1595	Complete system; page editor
WpDaisy	InfoSoft Systems, Inc. 25 Sylvan Road South Westport, CT 06880	I/OS (InfoSoft) or CP/M OS, 1 disk 32K RAM Direct cursor addressing or memory-mapped CRT	$450 (I/OS) $495 (CP/M)	
Word-Star	MicroPro International 1299 4th St., Suite 400 San Rafael, CA 94901	CP/M or MPM OS 48K program size Any CRT or video board 16×64 or larger (memory-mapped)	$495	
Wordcraft 80	Commodore 950 Rittenhouse Road Norristown, PA 19403	CBM 8030	$395.00	Available only at CBM dealers
Text Formatting Programs				
WORD-4	Micro Architect, Inc. 96 Dothan Street Arlington, MA 02174	TRS-80 Level I/ II with TRSDOS 16K program size	$49	
Text Processing System	Technical Systems Consultants Box 2570 W. Lafayette, IN 47906	8K program size	$60	
TEX	Digital Research P. O. Box 579 Pacific Grove, CA 93950	CP/M OS 24K program size	$75	
TFS	Supersoft Associates P. O. Box 1628 Champaign, IL 61820	CP/M OS 24K program size	$85	$250 for source in 8080 assembler
TEXTWRITER III Release 3.5	Lifeboat Associates 2248 Broadway, Suite 34 New York, NY 10024	CP/M OS 32K RAM	$125	
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CIRCLE 14

Computer-Aid for Word Puzzles

BY W. B. GOLDSMITH, JR.

I am a crossword puzzle addict. I chose my favorite newspaper by the enjoyment I get from its crossword feature. Lately, I've discovered that designing puzzles is more fun (and challenge) than solving them. Now, I doodle in checker-board patterns. If you share my vice, you'll probably enjoy this program.

Crossword puzzle construction is more art than science, so I doubt that a puzzle constructed completely by computer would be satisfying. There are areas of puzzle design that beg for computer help, though.

There are three basic steps in constructing a crossword puzzle. The designer must settle on a word pattern, fill in the pattern with interlocking words, and make up clues for the entries.

Pattern design is sheer delight once you know the rules. Rules are established by custom — and by editors/publishers if you plan to construct puzzles commercially. General requirements include grid size limitations, maximum black space allowed, and acceptable word count. (Most daily newspapers, for example, like a 15 × 15 square grid with no more than 20 percent black space and a maximum of 78 words.) As you've probably noticed if you're a puzzle fan, patterns must by symmetrical. While pattern layout could be handled by computer, I'd rather do it by hand — it's fun!

Clue writing is the step that makes or breaks the puzzle. If the clues are too easy, the puzzle is no fun for the solver. Obscure clues, on the other hand, can make the solution impossible. Judgment is required in devising clues, and the present state of our personal computer art won't permit much automation in this area. Besides, the memory requirements for the dictionary with clues would be horrendous.

A frequent PC *contributor, Mr. Goldsmith's previous articles include "Depreciation Schedules" (December 1980), "Number Converter" (November 1980) and "Income Statements" (October 1980).*

Filling the pattern with interlocking words is a ripe area for computer aid. You could spend hours looking for an eight letter word that ends in "d" with "e" as the third letter and "a" as the fifth ("elevated" is one). We can let our electronic servants do some of that searching and take the drudgery out of puzzle building. That's where "Computer Aid for Word Puzzlers" comes to the rescue. This program won't do the interlocking — that's part of your fun in puzzle making — but it will do some speedy list searching. (You can control how "speedy" by the way you construct your data dictionary, but more on that later.)

User's Notes

Computer Aid is a snap to use. The Sample Run illustrates a word search sequence. Type in the number of letters in the target word, and enter the letters you know (or that must match) by position in the word (1st, 2nd, 3rd and so forth) and letter. Your personal computer will search its data word list and present you with a menu of words that satisfy your specifications. You can even specify that "0" (zero) letters must match and get a print-out of all of the words of a specified length. All needed entries are prompted by the routine, and all prompts require a single entry response — either a number or a letter.

Programming Notes

Computer Aid is written in SWTP 8K Basic, Version 2.0. It should adapt easily to other Basic's with character string variables and one-dimensional matrix capability. The matrix capability is used for data manipulation, so you must have it. The toughest part of key-punching Computer Aid will be the data dictionary. By the time you leave out the REM's and some of the error trapping, the working part of the program is only about 25 lines long. The dictionary, however, can be as long as your RAM will allow. Let's look at Computer Aid line by line and explore the features.

Lines 10 through 80 constitute the header and are pretty self-explanatory and non-executable. Line 90 prints a title on your terminal to give the operator confidence that the proper program is running. Line 90 is one of the two statements that use the multiple statement per line capability of my Basic. The colon and second PRINT are the second statement on line 90. If your Basic interpreter won't handle multiple statements per line, you can make the second PRINT line 95 (or forget it).

Line 100 is the word length prompt, and line 110 is the input cue for necessary matches in the word. There is a potential need for an error trapping routine here that I didn't include. It is possible to specify more necessary matches than the number of letters in the word. When you try that, your computer will try the search and fail, wasting your time for that run.

Line 120 allows you to skip the position/letter entry sequence if you don't care how many letters match. It also drives a print of all words in the dictionary of the length specified.

Lines 130 through 190 use a FOR/NEXT loop to let you specify the particular letters and positions for each word search. Line 160 is an error trap to insure that your computer can search only one letter per position. If you want to streamline the program and save a bit of program memory for dictionary use, you could omit 160. (A double letter entry for any position will guarantee a failed search later, but won't cause any unrecoverable problems.)

Lines 200 through 290 hold the heart of the program — the dictionary search. Each word in the data dictionary is read into variable N$ by line 200 and discarded by line 220 if the length doesn't match the target word length. The last data entry is THE END. Line 210 decodes that final entry to tell your program that the word list is exhausted. If you forget to end your data list with THE END, your Basic will probably give you an OUT OF DATA error message when it gets to the last of the list.

Line 230 sets variable E to zero. This provides a flag function that controls the print statement in line 280. Any time a data word fails to match the requirements, E is incremented. Words matching all requirements carry an E "flag" of zero and will be printed by statement 280. You could use this "flag" to help speed the routine, also. A statement like:

0265 IF E=1 THEN K=H

will terminate the matching routine of lines 250 through 270 when the first mismatch occurs, instead of trying all possible combinations. When I'm really hard up for a word match, I'll change 280 to allow words with one mismatch to be printed.

0280 IF E<2 PRINT TAB (6); N$

will do that trick.

Line 240 allows you to skip the matching sequence when you desire a list of all the words in the dictionary of a particular length. The FOR/NEXT loop of 250 through 270 does the actual letter matching.

Statements 300, 310 and 320 are the end-of-list message to the operator. You can save some more memory and keypunching time by replacing the three lines with:

0300 PRINT "END"

Lines 330 through 400 are the last pieces of the operating program, and are a routine to allow you to look for other words or quit for the session. Line 330 is the second (of two) lines that use the multiple statement per line feature. You could leave out the PRINT: or assign an interim line number to it if your Basic won't be happy with multiple statements on a line. Most of these end game statements are error trapping, so you could omit them without much damage (you may get error messages from your Basic, but nothing will be damaged).

Lines 350 and 360 are vital if you want to search for more than one word per run. The Basic data pointer is aimed at the end of the list after one run, and the RESTORE statement of line 350 resets it for another search. The GOTO 100 of line 360 is obviously needed for a recycle through the search routine.

In the Program Listing, lines 1000 through 1050 and 9999 are DATA statements. You can use all lines from 410 through 9999 for data. I've included a short data list for purpose of illustration. All of the words in the listing are eight letter

Program Listing

```
0010 REM ***********************************
0020 REM * COMPUTER AID FOR WORD PUZZLERS *
0030 REM *          COPYRIGHT 1979         *
0040 REM *        W.B.GOLDSMITH, JR.       *
0050 REM *       LAKEWOOD, CA  90712       *
0060 REM ***********************************
0070 REM - PERMISSION GRANTED TO COPY FOR
0080 REM - PERSONAL USE ONLY.
0090 PRINT "CROSSWORD PUZZLE HELP":PRINT
0100 INPUT "HOW MANY LETTERS IN WORD",L
0110 INPUT "HOW MANY LETTERS MUST MATCH",H
0120 IF H=0 THEN 200
0130 PRINT
0140 FOR J=1 TO H
0150 INPUT "WHAT LETTER",A$(J)
0160  A$(J)=LEFT$(A$(J),1)
0170 INPUT "WHAT POSITION IN WORD",P(J)
0180 NEXT J
0190 PRINT
0200 READ N$
0210 IF N$="THE END" THEN 300
0220 IF LEN(N$)<>L THEN 200
0230  E=0
0240 IF H=0 THEN 280
0250 FOR K=1 TO H
0260 IF MID$(N$,P(K),1)<>A$(K) THEN E=E+1
0270 NEXT K
0280 IF E=0 PRINT TAB(6);N$
0290 GOTO 200
0300 PRINT
0310 PRINT "THAT'S THE END OF THE DATA LIST!"
0320 PRINT "HOPE ONE OF THESE WORKS FOR YOU."
0330 PRINT :INPUT"ANOTHER WORD",Z$
0340 IF LEFT$(Z$,1)<>"Y" THEN370
0350 RESTORE
0360 GOTO 100
0370 IF LEFT$(Z$,1)="N" THEN END
0380 PRINT "I DON'T UNDERSTAND ";Z$
0390 PRINT "PLEASE ANSWER 'YES' OR 'NO'."
0400 GOTO 330
1000 DATA MACHINES,TENEMENT,AIRPLANE,SCHEDULE,
     CONTROLS,DOCUMENT
1010 DATA RELIABLE,ENGINEER,ATTACHED,ELECTRIC,
     TEMPLATE,DELIVERY
1020 DATA INTERNAL,GENERATE,FUNCTION,ECONOMIC,
     REFERENT,GENEROUS
1030 DATA REFLECTS,COMPUTER,ELECTRON,CONNECTS,
     AVIATION,ELEVATOR
1040 DATA COMPOSER,GARDENER,IRRIGATE,FEBRUARY,
     NOVEMBER,DECEMBER
1050 DATA MECHANIC,PRODUCTS,GOVERNED,THEMATIC,
     ATTRACTS,SPECIALS
1060 REM
1070 REM - YOU CAN USE THE LINE NUMBERS
1080 REM - FROM 1070 TO 9990 FOR OTHER
1090 REM - DATA STATEMENTS AND ADD AS
1100 REM - MANY OTHER WORDS AS YOUR
1110 REM - DICTIONARY OR RAM WILL ALLOW.
1120 REM
1130 REM - ONE TRICK I USE IS TO KEEP A
1140 REM - FAIRLY SHORT LIST IN MEMORY
1150 REM - AND "APPEND" ADDITIONAL LISTS
1160 REM - OF WORDS AS THE PUZZLE GETS
1170 REM - TOUGHER.  (THE SHORTER THE
1180 REM - LIST IN ACTIVE MEMORY, THE
1190 REM - QUICKER WILL BE EACH SEARCH!)

9999 DATA "THE END"
```

words, but you can include words of any length. The true limitation on data capacity is the amount of program memory in your personal computer.

There is a trade-off between dictionary size and program run time. As the dictionary grows, the program slows. I've gotten around that problem by having several dictionaries on my storage device (disk or tape) and APPENDing them in at the proper time. To make this method somewhat efficient, I usually save up word searches until I have a bunch to do (I found that if I work on four or five puzzles at one time this helps). I then search for all the words on each list at one session. Try a couple of ways to see which suits you best. Your Basic may be a lot faster than mine (some of the compiled Basics are advertising spectacular speed increases), and a dictionary that pushes the size of available RAM may not cause you any time penalty. □

Sample Run

```
HOW MANY LETTERS IN WORD? 8
HOW MANY LETTERS MUST MATCH? 2

WHAT LETTER? E
WHAT POSITION IN WORD? 2
WHAT LETTER? E
WHAT POSITION IN WORD? 4

     TENEMENT
     GENERATE
     REFERENT
     GENEROUS
     DECEMBER

THAT'S THE END OF THE DATA LIST!
HOPE ONE OF THESE WORKS FOR YOU.

ANOTHER WORD? YES
HOW MANY LETTERS IN WORD? 8
HOW MANY LETTERS MUST MATCH? 2

WHAT LETTER? O
WHAT POSITION IN WORD? 2
WHAT LETTER? C
WHAT POSITION IN WORD? 1

     CONTROLS
     COMPUTER
     CONNECTS
     COMPOSER

THAT'S THE END OF THE DATA LIST!
HOPE ONE OF THESE WORKS FOR YOU.

ANOTHER WORD? YUP
HOW MANY LETTERS IN WORD? 8
HOW MANY LETTERS MUST MATCH? 2

WHAT LETTER? C
WHAT POSITION IN WORD? 3
WHAT LETTER? H
WHAT POSITION IN WORD? 4

     MACHINES
     MECHANIC

THAT'S THE END OF THE DATA LIST!
HOPE ONE OF THESE WORKS FOR YOU.

ANOTHER WORD? NO
```

Watts Happening

BY J. F. SULLIVAN

Receiving an electric bill these days can be a shocking experience. My usual reaction is "How did I use all that electricity?" This program, by itself, will not reduce your electricity use but it will give you an idea of where it is being used. The program is based on the amperes that an appliance uses. Multiply the amps by the line voltage and you get watts. The electric company charges for the number of kilo-watt hours you use. If an appliance uses 1000 watts and you leave it on for an hour, you've used 1 kw/hr. The national average cost for a kw-hr is about 5 cents. However each electric bill I've received recently warns that the cost will probably double over the next year or so.

The program allows input of either amps or watts. Wattmeters are not very common test tools but some of the new DVMs (Digital Volt Meters) coming on the market have AC Amp scales. You could just read the watts (or amps) from the data plates of many appliances but in most cases the figure given is a maximum. This is not as accurate as measuring the actual current draw. Also, the watts used will change slightly with changes in your line voltage.

To use the program you will have to go around your house and record the current draw (or watts) of every appliance. *Be very careful doing this . . .you are working with 110 volts. For 220 volt appliances it would probably be better to use the watts from the data plate.*

For some items you will get two (or maybe three) different values for different modes of operation. For example, I have one of those automatic coffee makers. It draws 8.3 amps when boiling the water but only .6 amps to keep the coffee (in my case, tea) warm. It is

Mr. Sullivan works as a training administrator preparing and presenting classes on theory and maintenance of clinical and research instrumentation.

Sample Run

```
LINE VOLTAGE ASSUMED AS 115 VOLTS; KW/HR COST AS $0.05.
IF DIFFERENT, CHANGE LINES 70 & 80.

#1 ESTIMATED USE
#2 SEE/EDIT APPLIANCE LIST
#3 ADD APPLIANCE

ROUTINE # ? (9 TO QUIT) 1

ESTIMATED ELECTRICITY USE PER DAY

COMPUTER          WATT-HOURS =  6900.00;  COST/DAY =   $.35
COMPUTER LIGHT    WATT-HOURS =   632.50;  COST/DAY =   $.03
STEREO            WATT-HOURS =   172.50;  COST/DAY =   $.01
TV                WATT-HOURS =   879.75;  COST/DAY =   $.04
4 CHL             WATT-HOURS =   103.50;  COST/DAY =   $.01
CHAIR LITE        WATT-HOURS =    57.50;  COST/DAY =   $.00
HANG LAMP         WATT-HOURS =   201.25;  COST/DAY =   $.01
REFRIG NORM       WATT-HOURS =   993.60;  COST/DAY =   $.05
REFRIG COMP       WATT-HOURS =  3864.00;  COST/DAY =   $.19
STOVE             WATT-HOURS =    27.60;  COST/DAY =   $.00
OVEN              WATT-HOURS =    86.25;  COST/DAY =   $.00
WATER BOILER      WATT-HOURS =   954.50;  COST/DAY =   $.05
WATER WARMER      WATT-HOURS =   483.00;  COST/DAY =   $.02
THERMOSTAT        WATT-HOURS =   358.80;  COST/DAY =   $.02
GARAGE TERM       WATT-HOURS =   414.00;  COST/DAY =   $.02

CONTINUE?

NITE OWL          WATT-HOURS =    55.20;  COST/DAY =   $.00
SECURITY SYSTEM   WATT-HOURS =   165.60;  COST/DAY =   $.01

KW-HRS PER DAY =   16.35;  COST =   $.82
          (OVER 60 DAYS THAT'S  $49.05)

#1 ESTIMATED USE
#2 SEE/EDIT APPLIANCE LIST
#3 ADD APPLIANCE

ROUTINE # ? (9 TO QUIT) 3

ADD APPLIANCE

NAME? PORCH LITE
AMPS OR WATTS? (A/W) A
AMPS? .45
ESTIMATED HOURS PER DAY? 12

ANOTHER ONE? (Y/N) N
```

continued

labeled 1175 watts showing the difference between actual current used and the maximum on the label. For permanent fixtures that do not plug in, you'll have to estimate. Usually these are ceiling lights so you can just read the watts from the bulb.

When you have all the data for everything in your home that uses electricity, you are ready to use the program: enter data on an appliance; change data on an appliance; and see the figures on costs of use.

The program is in North Star Basic and uses a disk file to store the data. This way you can update the information when you get new appliances or reduce your use of some items. Routine #3 is used to add appliances to the list. There is room for 50 entries. First enter the name (15 characters maximum), then the amps or watts, then the estimated hours of use per day.

When all items have been entered, use Routine #1 to see the estimated use and cost. The "over 60 days cost" is given because that is the period of my electric bill. Now compare the "kilowatt-hours per day" with the same figure on a recent electric bill. You may want to adjust the "hours of use" figures to get a more accurate estimate. Once you get the program's estimated total use-per-day close to the actual use-per-day shown on your bill you can start to make use of the information. You want to know which items are contributing the most to that total; you may be surprised which ones they are. I found that my computer is the number one user of electricity. I leave it on 24 hours a day because it handles many control functions for lights, and so-forth. Also I'm gradually tying my home security system into the computer. It's costing me 35 cents a day but I guess it's worth it. Using the program encouraged me to see if I could remove some boards that are not used very often and to unplug the Teletype when its not being used. (A Model 33 TTY draws about .24 amps just sitting with the motor off. That's 650 watts a day.) What really surprised me was that my refrigerator is the number two user. It's costing 24 cents a day. Time to look for a more efficient unit!

There are several subroutines used in the program. Lines 370 to 400, 410 to 460, 470 to 480 are used both to enter a new item and for editing the list. Lines 530 to 660 show the variables used in the program. (They are REMARK statements but because they follow the end of the program they do not need the REM. This trick might not work with

```
#1 ESTIMATED USE
#2 SEE/EDIT APPLIANCE LIST
#3 ADD APPLIANCE

ROUTINE # ? (9 TO QUIT) 2

EDIT APPLIANCE LIST

I'LL SHOW EACH LIST ITEM, YOU INDICATE ANY CHANGES...

COMPUTER          AMPS: 2.5; HOURS/DAY 24
CHANGES? (Y/N)

COMPUTER LIGHT    AMPS: 1.1; HOURS/DAY 5
CHANGES? (Y/N)

SECURITY SYSTEM AMPS: .06; HOURS/DAY 24
CHANGES? (Y/N)

PORCH LITE        AMPS: .45; HOURS/DAY 12
CHANGES? (Y/N) Y
DELETE THIS ONE? (Y/N) N
CHANGE NAME? (Y/N) N
CHANGE AMPS? (Y/N) Y
AMPS OR WATTS? (A/W) A
AMPS? .5
CHANGE HOURS? (Y/N) Y
ESTIMATED HOURS PER DAY? 25
???...
ESTIMATED HOURS PER DAY? 12


#1 ESTIMATED USE
#2 SEE/EDIT APPLIANCE LIST
#3 ADD APPLIANCE

ROUTINE # ? (9 TO QUIT) 1

ESTIMATED ELECTRICITY USE PER DAY

COMPUTER          WATT-HOURS =  6900.00; COST/DAY =  $.35
COMPUTER LIGHT    WATT-HOURS =   632.50; COST/DAY =  $.03
STEREO            WATT-HOURS =   172.50; COST/DAY =  $.01
TV                WATT-HOURS =   879.75; COST/DAY =  $.04
4 CHL             WATT-HOURS =   103.50; COST/DAY =  $.01
CHAIR LITE        WATT-HOURS =    57.50; COST/DAY =  $.00
HANG LAMP         WATT-HOURS =   201.25; COST/DAY =  $.01
REFRIG NORM       WATT-HOURS =   993.60; COST/DAY =  $.05
REFRIG COMP       WATT-HOURS =  3864.00; COST/DAY =  $.19
STOVE             WATT-HOURS =    27.60; COST/DAY =  $.00
OVEN              WATT-HOURS =    86.25; COST/DAY =  $.00
WATER BOILER      WATT-HOURS =   954.50; COST/DAY =  $.05
WATER WARMER      WATT-HOURS =   483.00; COST/DAY =  $.02
THERMOSTAT        WATT-HOURS =   358.80; COST/DAY =  $.02
GARAGE TERM       WATT-HOURS =   414.00; COST/DAY =  $.02

CONTINUE?

NITE OWL          WATT-HOURS =    55.20; COST/DAY =  $.00
SECURITY SYSTEM   WATT-HOURS =   165.60; COST/DAY =  $.01
PORCH LITE        WATT-HOURS =   690.00; COST/DAY =  $.03

KW-HRS PER DAY =   17.04; COST =   $.85
          (OVER 60 DAYS THAT'S  $51.12)

#1 ESTIMATED USE
#2 SEE/EDIT APPLIANCE LIST
#3 ADD APPLIANCE

ROUTINE # ? (9 TO QUIT) 9
```

some Basics.)

It should not be too difficult to change the program for other Basics. The expression in line 150, !A$ (I*15-14,I*15) would become a MID$ function in Microsoft Basics: MID$ (A$,I*15-14,15). ('!' is the short form for PRINT in North Star.) There are several formatting statements that would have to be changed to PRINT USING statements. For example in line 190, %$7F2 sets up a 7 character field starting with a dollar sign; the F indicates a floating point number; the 2 indicates two figures are to be printed to the right of the decimal point. You could get by without the disk (or cassette) data file but you would have to re-enter all the information every time you want to use the program. In that case leave out lines 40 through 60 and, lines 490 through 510 and move 520 to 490. If you do use the file you'll have to intialize it before using the program for the first time. Run the following 1 line program:

```
10 OPEN #0, "WATDATA" :WRITE #0,0:CLOSE #0
```

As written there is room for 50 entries. You can increase this by changing the dimension statements in line 20. Change the first variable of the W array and change the space for A$ to 15 times the number of entries. I use the program on an 80 character-per-line video terminal but it will work on a 64 character-per-line unit with no changes. Line 170 is used to put the display of the list in groups of 15 items so they will not scroll off of the screen. It can be deleted if you use only a printer.

You might find some places where you can reduce your use of electricity and save money. □

Program Listing

```
10 REM WATTS W 6/80
20 DIM A$(750),A1$(20),W(50,1)
30 !TAB(34),"WATTS"\A$=""
40 OPEN #0,"WATDATA"\READ #0,N\IF N=0 THEN 60
50 FOR I=1 TO N\FOR J=0 TO 1\READ#0,W(I,J)\NEXT\NEXT\READ #0,A$
60 CLOSE #0
70 !\!"LINE VOLTAGE ASSUMED AS 115 VOLTS; KW/HR COST AS $0.05."
80 !"IF DIFFERENT, CHANGE LINES 70 & 80."\V=115\C=.05
90 !\!"#1 ESTIMATED USE"\!"#2 SEE/EDIT APPLIANCE LIST"
100 !"#3 ADD APPLIANCE"
110 !\INPUT"ROUTINE # ? (9 TO QUIT) ",R\IF R=9 THEN 490
120 IF R<1 OR R>3 THEN 90\ON R GOTO130,210,340
130 !\!"ESTIMATED ELECTRICITY USE PER DAY"
140 L=0\U1=0\!\FOR I=1 TO N\U=W(I,0)*W(I,1)*V\U1=U1+U
150 !A$(I*15-14,I*15)," WATT-HOURS = ",%7F2,U,
160 !"; COST/DAY = ",%$5F2,C*U/1000
170 L=L+1\IF L<15 THEN 180\!\INPUT"CONTINUE? ",R$\!\L=0
180 NEXT I
190 !\!"KW-HRS PER DAY = ",%6F2,U1/1000,"; COST = ",%$5F2,C*U1/1000
200 !TAB(10),"(OVER 60 DAYS THAT'S ",%$7F2,60*C*U1/1000,")"\GOTO90
210 I=0\F=1\!\!"EDIT APPLIANCE LIST"
220 !\!"I'LL SHOW EACH LIST ITEM, YOU INDICATE ANY CHANGES..."\!
230 I=I+1\!A$(I*15-14,I*15)," AMPS:",W(I,0),"; HOURS/DAY",W(I,1)
240 INPUT"CHANGES? (Y/N) ",R$\IF R$<>"Y"THEN 330
250 INPUT"DELETE THIS ONE? (Y/N) ",R$\IF R$<>"Y" THEN 290
260 IF I=N THEN 280
270 W(I,0)=W(N,0)\W(I,1)=W(N,1)\A$(I*15-14,
    I*15)=A$(N*15-14)
280 N=N-1\A$=A$(1,N*15)\GOTO330
290 INPUT"CHANGE NAME? (Y/N) ",R$\IF R$<>
    "Y"THEN 310
300 !"CORRECT ",\GOSUB370\A$(I*15-14,I*15)=
    A1$(1,15)
310 INPUT"CHANGE AMPS? (Y/N) ",R$\IF R$<>
    "Y" THEN 320\GOSUB410
320 INPUT"CHANGE HOURS? (Y/N) ",R$\IF R$<>
    "Y"THEN 330\GOSUB470
330 !\IF I>=N THEN 90\GOTO230
340 F=1\!\!"ADD APPLIANCE"
350 N=N+1\!\GOSUB370\A$=A$+A1$(1,15)
    \GOSUB410\GOSUB470
360 !\INPUT"ANOTHER ONE? (Y/N) ",R$\IF R$=
    "Y"THEN 350\GOTO90
370 INPUT"NAME? ",A1$\IF LEN(A1$)<=15 THEN 400
380 !"THAT WILL BE SAVED AS '",A1$(1,15),\
    INPUT"'; OK? (Y/N) ",R$
390 IF R$="Y"THEN RETURN\GOTO370
400 IF LEN(A1$)>=15 THEN RETURN\A1$=A1$+" "
    \GOTO400
410 INPUT"AMPS OR WATTS? (A/W) ",R$\IF R$="A"
    THEN 430
420 IF R$<>"W"THEN 410\INPUT"WATTS? ",W\W(I,0)=
    W/115\GOTO440
430 INPUT"AMPS? ",W(I,0)
440 IF W(I,0)<=0 THEN 410\IF W(I,0)<30
    THEN RETURN
450 !"PLEASE CONFIRM...",W(I,0),\INPUT" AMPS?
    (Y/N) ",R$
460 IF R$<>"Y"THEN 410\RETURN
470 INPUT"ESTIMATED HOURS PER DAY? ",W(I,1)
480 IF W(I,1)>0 AND W(I,1)<=24 THEN RETURN\!"?
    ??..."\GOTO470
490 IF F=0 THEN 520\OPEN #0,"WATDATA"\WRITE #0,N
500 FOR I=1 TO N\FOR J=0 TO 1\WRITE #0,W(I,J)
    \NEXT\NEXT
510 WRITE #0,A$\CLOSE #0
520 END
530 W(I,0 = AMPS
540 W(I,1 = HRS PER DAY
550 I = POINTER
560 N = NMBR ITEMS ON LIST
570 A$ = NAMES, 15 CHARACTERS EACH
580 A1$ = INPUT NAME STRING
590 L = LINE COUNTER, ROUTINE #1
600 F = FLAG, 1 IF LIST CHANGED
610 R = ROUTINE NMBR
620 U = WATT-HOURS/DAY
630 U1 = TOTAL WATT-HRS/DAY
640 V = LINE VOLTAGE
650 C = COST KW/HR
660 R$ = GENERAL RESPONSE STRING
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How to Plan For Your Business Computer

BY LARRY WATKINS

You've finally picked a computer system for your business and you think you've got all the software bases covered. Great! Now I'd like to throw a few wrinkles into the picture.

Computers can lower workloads and help with time consuming jobs. But, they can also create havoc within your organization, totally demoralize your people and lose information requiring hours to recover. If you're not scared off yet let's investigate some problem areas and head them off now.

Some of the areas I'd like to discuss are: choosing a hardware vendor or a software vendor; doing it yourself; turnkey packages; the computer room; working areas; security; power; temperature and humidity; fire protection; and operational procedures.

Let's consider hardware. The big names in hardware have a lot to offer the first-time user from a minicomputer to an entry-level microcomputer. Although these companies can assist you in planning for your new computer, they can be most valuable to you after your system is in and running. Maintenance of your computer should be of utmost importance to you if you're going to commit your business to it. The service organizations of these companies offer many levels of technical and logistical support. Sometimes a piece of equipment just can't be fixed and should be replaced or refurbished. Most service contracts take this possibility into account. Going this route is the most expensive in terms of one-time cash outlay but having one worldwide company to service your computer can pay back many unseen dividends.

You say you've evaluated these possibilities and there's no way you can afford all that expense. What are your alternatives? What started as the hobby computer market has grown into the microcomputer business market, putting business computing within the reach of many small businesses like yours. Where do you go to get one of these?

First, there is the mail order market which I would recommend only to the technically competent — unless you don't mind spending a lot of time talking long distance to get questions answered, or sending your equipment away for weeks or months for repairs while your work piles to the ceiling. Now, don't get me wrong. I'm not down on mail order — my own personal/business system was largely mail order. I'm just saying that mail order is probably the most frustrating type of system purchase because so many of the components are out of your immediate control.

Another means to obtain a small business computer is the local distributor or computer store. Critics of the computer store approach point out that none of these stores have been in business very long and a lot have gone out of business.

Gone are the days of the "Promise them anything but get their name on the line" approach. Any company that does business this way won't be in business long. Do keep in mind though that Fred's Computer Mart, Car Wash and Massage Parlor can't afford to spend six months selling you a ten thousand dollar business system like IBM can.

Servicing Your System

There are several approaches to servicing your system. One is return-to-factory service. This approach has been used in servicing wrist watches and transistor radios. But given the weight and size of microcomputers, and the business necessity of having operational equipment, this approach is usually the poorest.

The most expensive but usually the most thorough approach is on-site contract service from the vendor or a third party maintenance company. Contract vendor maintenance will usually include all parts, labor, preventive maintenance, engineering update services and remedial maintenance. You should also have wording to cover the unfixable machine, usually defined as one that can be fixed given enough parts, time and customer good will. Usually the good will gives out first as getting the machine running becomes the utmost priority and the machine is usually replaced because the device costs less to replace than to repair on site. This point can be a major difference in service contracts.

All your hardware from one vendor serviced by that vendor can easily be replaced by that vendor. A mixed vendor system serviced by a third party can cause some problems if the device has to be replaced. The third party may not have access to replace someone else's equipment. Several of the minicomputer companies guarantee response time to a service call and continuous manpower until the problem is resolved. More of the smaller vendors and third party concerns will offer this type of service to be more competitive.

Contract service from your local store should cover all the

same points that a contract from a large company does. Make sure you cover unfixable equipment, replacements, or loaners now. Just because a micro is smaller doesn't mean it's easier to fix.

One other approach to maintenance is on a billable basis: so much an hour plus parts and expenses. This fee ranges from twenty-five dollars an hour to one hundred dollars an hour and usually has no guarantees except warranty on parts used. Most service groups only take care of non-contract customers after they have cleared away calls from their contract customers. Over a given amount of time (let's say five years, a normal life expectancy of a system) per call charges will about balance with contract rates.

Whatever hardware maintenance choice you make be sure you have made the best decision possible for your business. The best decision may not always be the cheapest or the most expensive.

Getting Your Software

Software concerns follow the same basic paths as hardware. The larger hardware vendors offer comparable software products. They offer operating systems, some application programs and some packages.

A package is a collection of programs usually written for a specific market (the massage parlor industry) and isn't exactly what your particular needs are. A good package will do eighty-five per cent of your work without you changing your procedures. Packaged programs can be changed but usually the cost isn't worth it. Changing fifteen per cent of your operational procedures may not affect you, or it may destroy your business or it may help. The best approach with a packaged system is to try your bookkeeping system (or whatever application you're using) on it to test its impact on your business.

Not all programs you buy will be your personal property. Some will be sold to you on a license for you to use for a specified amount of time. You may or may not receive the source listings for that program. A source listing is a readable format that can be used to make changes for your business. Some source listings just aren't available under any circumstances and some are. Having the listings even if you never use them sure can't hurt.

One last thing to cover in the major pre-purchase area is documentation and training. Will you and your people be given schooling to train you in the proper usage of both the hardware and software? You should be. Where will the training be held — your place or theirs? Will there be any hidden costs or expenses? And will documentation be left with you to refer to for those small, day to day operational questions (Is 3/3/80 the same as 3-MAR-1980?).

Before you sign for any software package be satisfied that the contract states exactly what the software and the software vendor will do and not do for your business.

Now that we've bought your computer and software for you let's look at your business to see how a computer operation should and will fit in. Placement of the computer should be your first priority. Obviously you don't want an IBM 370 in your showroom and just as obviously you don't want an Apple on the counter where customers can touch it.

The larger the computer the larger the area required. Employee usage and security are two major factors to guide where you put the equipment.

Let's get specific. You just bought a North Star Horizon with two terminals and one printer to run your gift shop. The person on the counter will need a CRT (cathode ray tube) for accessing inventory and a printer for invoicing/sales slips. You need a CRT terminal to enter your bookkeeping items. Where should the computer be? Ideally it should be locked away where only you can get to it, but realistically it should be available to the people who have reason to use it. Your janitor would not normally require the use of the computer while your office manager would, to do backups (more about that later), to enter new inventory and to make price adjustments. It is difficult to justify a separate room for a Horizon but having it on your desk in a small office is inconvenient. Consider a separate desk and cabinet for supplies with a movable partition to block the system from prying eyes and to keep the sound down.

Keeping Your Data Secure

Data security is an area most computer salesmen won't bother to go into great detail about. Even the most trusted employee can destroy your data integrity if they want or even by accident. It's not a big deal for someone to buy a floppy diskette and take your data (payroll, inventory, accounts P/R) off the premises to hold for ransom.

Data security also includes back up copies and where they are kept. I recommend to my customers three sets of back up minimum, not all kept in the same place. I usually suggest an everyday set of media to run on (which in the case of floppy diskettes should be replaced periodically), an even day back up and an odd day back up. These should be kept in a secure fireproof place for convenient access. I also suggest a weekly backup set kept away from the place of business in a secure fireproof spot. With diskettes, this can easily be your bank's safety deposit box; it may seem like a little trouble but it could go a long way in helping to satisfy an insurance claim in the event of a fire, tornado or other disaster.

I also suggest multiple copies of the software be kept in separate, secure locations. And by all means whenever a software change is made back it up also. Computer media can be extremely fragile. There is no such thing as too many backup copies. I've witnessed several computer installations where all software was wiped out (quite often through carelessness) and downtime was extended.

Plan for a Disaster

Disaster planning is another area not mentioned often enough. Disaster could mean having your computer down for two days. What do you do in the meantime? Develop a disaster plan, test it periodically to make sure it works. What if your computer is down for two days? Is there another system of like make and configuration around that you can use or rent or has your vendor made a commitment to you in this area? Now is the time to find a way to continue processing, not when the roof leaks on the computer, requiring it to be totally rebuilt.

This is an excellent time to discuss insurance. No vendor's maintenance contract will cover a leaky roof ruining the computer. Will your insurance policy cover it? Be sure your policy will specifically cover your computer. A lot of policies won't without special riders attached. Most leasing companies require proof of such insurance before you sign the lease but on an outright purchase it could easily slip by.

What would you do if your business wasn't standing when you arrived in the morning? Start to rebuild? Proof of your inventory stored off-site would help with your claim. Adequate insurance on the building and contents can insure that you stay in business. You can even buy coverage to pay you while you're rebuilding your business and you have no cash flow.

Develop a disaster plan even for the small disasters, test it, rewrite it and retest it until it works. Test it periodically making sure it still works, because even the smallest changes

in the hardware or software could affect your backup procedures. Finding a compatible system close by for mutual backup is usually the most successful because the other party knows they may be in the same boat in the near future.

Power is something that has always been taken for granted until lately. It is no longer cheap and always available and may do your computer more harm than you realize. Most electric companies do their best to supply good clean power but once it leaves their generating facilities it's largely out of their hands and becomes subject to accidents, lightning, weather and even the equipment you hook up to it.

Power problems such as brownouts, other electrical equipment switching on and off, and electro magnetic interference (EMI) can cause problems with your computer that could look like computer problems, software problems or even operator problems and could go unresolved for a long time. As computer equipment becomes more complex the more critical good power becomes. Some of these problems require extremely sophisticated test equipment to isolate. Check with your vendor to see if they have any expertise in these areas.

If your business is in an area of poor power, lights flickering, high usage of light bulbs, blackouts, hums in the telephone or radio you may want to consider investing in power isolation or constant voltage equipment. Power isolation equipment will protect your system from electrical noise caused by electric motors being turned on and off. Constant voltage equipment will help to maintain a constant level of voltage to your system. This is of particular use in an area of brownouts or sagging power such as when the factory next door starts turning everything on at eight a.m. and the power dips to ninety-five volts. It is not unusual to see sags in voltage to as low as eighty-five volts or surges to one-hundred-forty volts or as much as three-hundred volts of impulse noise on a power circuit in almost any town in the country. Many smaller electrical suppliers don't even have the equipment to monitor for these conditions.

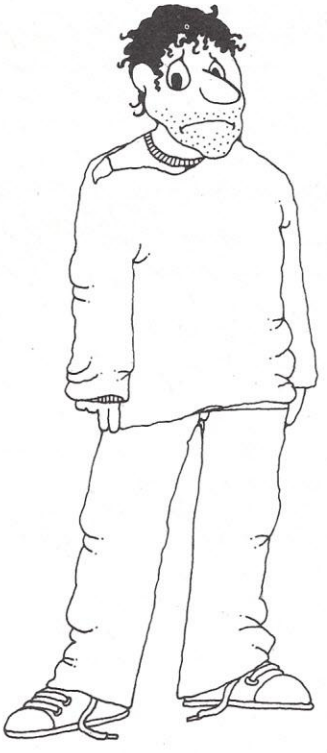
One other area of power that is easily overlooked is grounding. A computer should have isolated ground receptacles and all the computer equipment should share this separate isolated ground. A water pipe ground is not sufficient as electrolysis can set in and ruin your ground. An isolated ground should be installed by a competent electrician.

Static can bring a computer to its knees with one touch of the finger. Static can be brought under control by setting equipment on static mats and by proper humidity control. Humidity should be kept in the forty to sixty percent range. Printer problems rise dramatically during the winter due primarily to humidity problems. Only recently has the test equipment become sophisticated enough to prove many undefined system problems to be caused by static. A static discharge can easily induce twenty thousand volts into your computer.

Computers are being advertised as not needing special rooms and temperature controls. This is largely true. If it is too hot or too cold for humans then it's too hot or too cold for a computer. Temperatures should be stable and wide variations should be avoided.

I hope I've given you enough information to properly install your computer and handle it's day to day care. Remember, no stone is too small to leave unturned. If you don't know all about computers make sure you select vendors who can help solve potential problems. □

CLEAN UP YOUR ACT



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CIRCLE 18

A Pseudo-Numeric Key Pad for the Apple II

BY ROBERT A. PRITCHETT

When I was shopping for a microcomputer I nearly purchased a machine other than my Apple II because of its handy numeric key pad. Although I am very satisfied with my computer choice many times I have wished, perhaps blasphemously, that it had one of those handy numeric key pads. I am sure that many other Apple owners may have had that "uncomfortable" thought pop into their head from time to time — in fact, every time they have to enter many numbers as data for a processing application.

Considering that at least one hardware vendor is marketing a plug-in numeric key pad for the Apple, the $200 price tag is enough to make any Apple owner wonder if speed, convenience and easy one-hand operation is worth the money.

I am in the process of designing and writing a business software system for my current employer and the thought of having to enter all of those serial numbers (over 5000) using the current placement of the number characters, the decimal point and the ENTER (I know it's the RETURN) button was absolutely frightening.

That was it. The last straw. I had to have one. I simply had to have a numeric key pad even if I had to write a subroutine to simulate one.

The Psuedo-Numeric Key Pad Subroutine is a very useful addition to any program in which you are expecting to enter a large amount of numeric data. It acts as a keyboard filter and changes the right hand side of the keyboard into a numeric key pad (see Figure 1).

Some of the subroutine's special features include a double zero key (00), one-hand operation to enter both negative and decimal numbers and its numbered catalog display of numbers entered. The key pad characters are easy to locate and remember. If you make a mistake while typing in a number, just press the letter "E" to void it. The key pad is turned off and program control returns to the main program by pressing the letter "S". If you accidently hit a key that is not a character in the key pad it will make an audible "beep" to tell you to re-enter that number and prints a message on the screen. This allows you to keep your eyes on the data you are entering and not on the keyboard.

The only drawbacks I've found with the key pad (alas, there's always one or two) is that you can't see what you've typed until you type "P" (key pad ENTER key), and because it is written in Applesoft Basic it's a touch slow. But before you moan too loudly remember it can save you at least $200.

The key pad is laid out as a standard calculator using the Apple's 7,8 and 9 as themselves and the keys under them (slightly to the right) as the Home keys. That is, the U=4, the I=5 and the O=6. The key pad's 1, 2 and 3 are the Apple keys J, K and L respectively. The "M" is being used in this version as a double zero (00) and the Apple's own zero as the key pad single zero.

The "M" can easily be converted to a single zero digit if you think that would be more convenient. The Apple's dash and the comma are used to create negative numbers. The comma could be used as a single digit zero and allow the "M" to remain a double digit zero if you do not anticipate inputing many negative numbers. The key pad uses 16 keys for data entry but controls 24 keys altogether.

Program Note

Line 9020 is where the key pad stores the data entered for the main program use. Line 9100 makes use of the Applesoft GET command which will input a character from the keyboard without hitting the RETURN key but does not display the input character. If you really feel that you must see each digit or number as you enter it you might use the INPUT command but that would destroy the speed of the key pad and require a major rewrite of the subroutine.

Lines 9165-9185 are the translation section of this subroutine. I deliberately avoided changing any more keys than absolutely necessary for execution speed and reducing the size of the subroutine. Array PROG-DATA is loaded with the entered number in Line 9260. The key pad accepts all input as string data in Line 9240. This statement converts data from string type to real number.

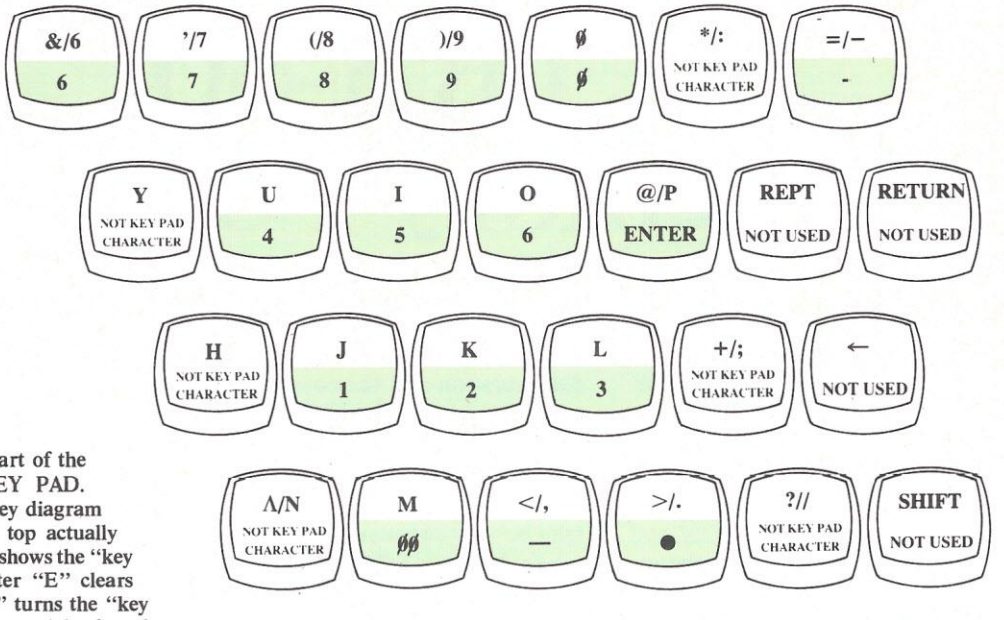
Lines 9310-9320 are the non-key pad character error output. It prints a message on the screen as well as sounding the bell. CALL -198 is a Apple monitor subroutine for the "beep". □

Mr. Pritchett is currently working towards a combined degree in Journalism and Computer Science at Ohio State University.

Sample Run

```
                        PSUEDO-NUMERIC KEY PAD
                  SPEED ENTRY (ORDER NUMBER & RECORD)

1       546
2       -8765
3       123
NOT KEY PAD CHARACTER * RE-ENTER
4       74790
5       1.98
6       354.987
7       -761.34
NOT KEY PAD CHARACTER * RE-ENTER
8       30
```



The shaded keys are a part of the PSEUDO-NUMERIC KEY PAD. The upper half of each key diagram represents what the key top actually shows, and the lower half shows the "key pad" character. The letter "E" clears errors, and the letter "S" turns the "key pad" off and restores normal keyboard functioing. Letters "U", "I", and "O" are used as the "Home" keys.

Program Listing

```
9000  REM PSUEDO-NUMERIC KEY PAD SUBROUTINE
9002  REM
9004  REM COPYRIGHT JUNE 1980
9006  REM
9008  REM BY ROBERT A. PRITCHETT
9010  REM
9012  REM THE CREATIVE MIND WORKSHOP
9014  REM
9016  REM ALL COMMERICAL RIGHTS RESERVE
9018  REM
9020  DIM PROG-DATA(80):  REM ENTERED DATA STORED
9022  REM                 HERE FOR YOUR PROGRAM
9024  DIM NKP$(10):       REM STORES INPUT KEY
9026  REM                 STROKES HERE
9028  SK=0:  REM KEYSTROKE COUNTER
9030  AK=1:  REM NUMERIC DATA COUNTER
9040  HOME
9050  HTAB 9
9060  PRINT "PSUEDO-NUMERIC KEY PAD"
9070  HTAB 3
9080  PRINT "SPEED ENTRY (ORDER NUMBER & RECORD)"
9090  SK=SK+1
9100  GET NKP$(SK)
9110  IF NKP$(SK)="P" THEN 9160
9120  IF NKP$(SK)="S" THEN 9350
9130  IF NKP$(SK)="E" THEN 9310
9140  GOTO 9090
9145  REM P-NUMERIC KEY PAD OUTPUT
9150  REM TO SCREEN & TO ARRAY "PROG-DATA"
9160  FOR I=1 TO SK
9165  IF NKP$(I)="0" THEN 9190
9166  IF NKP$(I)="9" THEN 9190
9167  IF NKP$(I)="8" THEN 9190
9168  IF NKP$(I)="7" THEN 9190
9169  IF NKP$(I)="6" THEN 9190
9170  IF NKP$(I)="U" THEN NKP$(I)="4"
9171  IF NKP$(I)="I" THEN NKP$(I)="5"
9172  IF NKP$(I)="O" THEN NKP$(I)="6"
9173  IF NKP$(I)="J" THEN NKP$(I)="1"
9174  IF NKP$(I)="K" THEN NKP$(I)="2"
9175  IF NKP$(I)="L" THEN NKP$(I)="3"
9176  IF NKP$(I)="-" THEN NKP$(I)="-"
9177  IF NKP$(I)="," THEN NKP$(I)="-"
9178  IF NKP$(I)="." THEN NKP$(I)="."
9179  IF NKP$(I)="M" THEN NKP$(I)="00"
9180  IF NKP$(I)=";" THEN GOTO 9300
9181  IF NKP$(I)="/" THEN GOTO 9300
9182  IF NKP$(I)="N" THEN GOTO 9300
9183  IF NKP$(I)="H" THEN GOTO 9300
9184  IF NKP$(I)="Y" THEN GOTO 9300
9185  IF NKP$(I)=":" THEN GOTO 9300
9190  NEXT I
9200  TEMP$=""
9210  FOR I=1 TO SK
9220  TEMP$=TEMP$+NKP$(I)
9230  NEXT I
9240  NTEMP=VAL(TEMP$)
9250  PRINT AK;"       ";NTEMP
9260  PROG-DATA(AK)=NTEMP
9270  AK=AK+1:  SK=0
9280  GOTO 9090
9300  REM  ***  PRINT ERROR MESSAGE
9305  REM  *** SOUND WARNING
9310  SK=0: CALL -198
9320  PRINT "NOT KEY PAD CHARACTER * RE-ENTER"
9330  GOTO 9090
9350  END:  REM OR YOU CAN PUT "RETURN" HERE
```

TRS-80 Memory Pointers

BY L. MITCHELL WEIN

TRS-80s have a number of useful features neatly buried in hidden memory locations. These features, rarely described, hold great potential for struggling Basic programmers. To use the characteristics effectively you need know nothing about assembly or machine language programming and yet you will still be able to change the way your machine operates. Using Basic, you can only affect a program, not the behavior of the machine itself.

Before we discuss the specific TRS-80 features that you can use, let's review memory locations. A memory location contains one byte of information with each byte containing eight bits; a byte can also be represented by two nybbles, each of which contains four bits. A bit is the smallest alterable component of a computer and can be thought of as a minute electronic switch that can be set on (1), or reset off (0).

Without getting into the complexities of binary (bit) representation, suffice it to say that each of the two nybbles in a byte can have a value from zero to fifteen. Rather than using decimal notation to indicate these values, we can use hexadecimal notation, which represents values from 10 to 15 by the letters A to F, allowing each of the two nybbles in a byte to be displayed as a single digit. The highest value of a single byte can be represented as 255/FFH. The 255 to the left of the slash is the value in decimal while the FF to the right of the slash is the same value represented in hexadecimal. The H is a reminder that hexadecimal notation is being used. The highest value of a two-byte location is 65535/FFFFH. For the TRS-80, 65535/FFFFH is also the highest possible value of an integer, a line number or a memory location. Do not confuse line numbers with memory locations; the former are labels for Basic program statements while the latter are fixed points in core storage.

Before getting into specific memory location features, here is a brief description of the TRS-80 memory configuration and the commands used to access specific locations.

Read Only Memory (ROM) extends from location 0/0H to location 16283/3FFFH. This area of memory, which may be viewed but never changed from the keyboard or software, can be altered only by connecting the card at the rear, upper left-hand corner of the keyboard to another ROM chip via a bus extender cable. Above this area are locations 16384/4000H through 17128/42E8H, which are used by the Basic ROM routines in setting pointers, stacks and registers. These locations can be altered from the keyboard or in software statements. Great care must be exercised in altering these locations, however, as mistakes can destroy a program. It's advisable to thoroughly test each alteration in this memory area before using the alteration in a program! Memory locations 17129/42E9H through 32767/7FFFH are used for Basic and machine language programs, variables, arrays, string space and related stacks. 32767/7FFFH is the highest memory location for a 16K system.

You can manipulate memory locations to increase your Basic programming effectiveness.

Basic commands that access memory locations are SYSTEM, PEEK, POKE, USR and VARPTR. SYSTEM is used to load a machine language program or to jump to a specific location to start a machine language routine. PEEK lets you view a byte stored in a memory location while POKE puts a value into a specific location.

The values viewed or placed, which range from 0/0H to 255/FFH, are transacted in decimal format. Values that are stored in two-byte addresses range from 0/0H to 65535/FFFFH and are stored with the Least Significant Byte (LSB) first and the Most Significant Byte (MSB) second. To understand the value at a two-byte address, you must convert the MSB to hexadecimal, multiply by 256/100H, convert the LSB to hexadecimal, add the LSB to the previous result and convert the answer to decimal. Calculations can be simplified by using the Texas Instruments "Programmer" calculator.

USR accesses a machine language routine from a Basic program and VARPTR indicates the location of a variable previously established in a Basic program.

One of the most important hidden features in the TRS-80 is the ability to affect the MEMORY SIZE? prompt without turning off the Central Processing Unit (CPU = keyboard). When the CPU is turned on, the MEMORY SIZE? prompt appears immediately. Your response to the prompt determines the "top" of Basic Random Access Memory (RAM). If you hit the Enter key, 32767/7FFFH bcomes the default value. String space and the stack for Basic programs extend downward from the partition that you create when you respond to the MEMORY SIZE? prompt. Machine language routines can be

located above the partition, which protects the routine from being overridden by a Basic program or its related variables, arrays, stack or string space. The usual way to alter the partition location is to turn off the CPU and then turn it on again. Unfortunately, this procedure also obliterates the rest of RAM and, if performed frequently during a session, causes an inordinate amount of wear on the CPU power switch.

A more sophisticated method to alter partition locations is to type the following:

SYSTEM
?/0

This procedure results in the MEMORY SIZE? prompt appearing and allows you to reset the partition. Though using this technique also results in the suspension of running machine language routines, memory is not obliterated and the machine language routines in memory can be reactivated by use of the SYSTEM command.

There is also a way to alter the memory partition location without suspending running machine language routines. The technique involves altering the bytes at locations 16561/40B1H, 16562/40B2H, 16598/40D6H and 16599/40D7H. A memory partition's value is held in two memory locations, each of which is two bytes long. All four bytes must be changed in relocating a partition or the results can be unpredictable.

For example, if you enter PEEK(16561), PEEK(16562), PEEK(16598), PEEK(16599) after defaulting to the MEMORY SIZE? prompt, you will get:

255 127 255 127

The MSB is equal to 127/7FH; multiplying by 256/100H gives you 32512/7F00H. The LSB is 255/FFH and, when added to your previous result, equals 32767/7FFFH. If a Basic program is in the system but isn't running (remember, changing the memory partition can alter strings or other variables), the partition can be dropped 55 bytes with the command POKE16561,200:POKE16598,200.

Another hidden feature of your machine is the ability to disable the Break key. If you PEEK location 16396/400CH, you get a value of 201/C9H. POKEing 23/17H into that location disables the Break key. This procedure can be used in either command or execution modes to prevent accidental interruption of a program or can be combined with other techniques to prevent listing or tampering with a program.

Two other locations can be useful to a Basic programmer. These addresses can be used to merge a second Basic program to a program already resident in your machine. (The line numbers of the second program must be greater than the line numbers of the resident program.) Here's a step-by-step procedure for merging Basic programs:

1. PEEK the values in the resident "program start pointer" located at 16548/40A4H and 16549/40A5H. Write the values down.
2. PEEK the values of the "program end/variable start pointer" located at 16633/40F9H and 16634/40FAH (call the value you find in 16633, A, and the value in 16634, B).
3. If A > = 2 then A=A−2 and B=B
   If A < 2 then A=A+254 and B=B−1
4. POKE A into location 16548
5. POKE B into location 16549
6. CLOAD your second program
7. POKE the values you obtained in step 1 back into locations 16548 and 16549.
8. LIST your program. You will find that you have combined both Basic programs into one program.

The reason for the numerical gyrations in step 3 is that the "program end/variable start pointer" always points two bytes ahead of the last line of the program. Those two bytes are each filled with a zero. One zero indicates the end of a line and the other indicates the end of the program.

Another use for the "program end/variable start pointer" comes into play when using Exatron Stringy Floppy wafers with the TRS-80. One wafer could contain a directory program plus several applications programs. If the applications programs use the same variables, a common value for the "program end/variable start pointer" could be POKEd by the directory program (assuming the variables are high enough in memory that none of the applications programs trample over them). The applications programs would also have to be chained to the directory program. Using this approach, each of the applications programs could be shuffled in and out of the CPU by the directory program with variable values remaining intact. Thus, one could have statistics programs, sort programs and display programs interacting with the same variables, thereby minimizing program usage of memory.

The last location of importance for the Basic programmer is 16526/408EH and 16527/408FH. This is the place where the start location of any machine language routines to be addressed by USR should be POKEd. □

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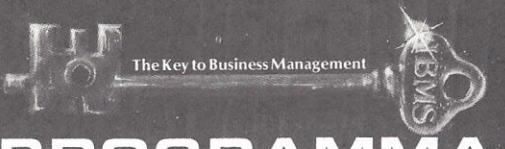

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The NEC-8001 Computer

BY ALAN M. BOYD

Japanese microcomputers have started their long-awaited invasion, and if the PC-8000 series of machines from Nippon Electric Company (makers of the NEC *Spinwriter*) is indicative of things to come, our domestic industry had better stay on its toes. From its color-coordinated packaging to its impressive video display capability, the PC-8001 personal computer is a winner. Company representatives haven't said what the U.S. price for the system will be but did state that the unit will be competitive with the Apple II.

Although the PC-8001 is just now becoming available in this country, the unit's variety of features makes it a popular system in Japan where it is in widespread use. NEC, well-known in the minicomputer field, used its extensive experience to design a consumer-oriented, desktop computer. The company included most of the popular features found on our domestic microcomputers and added a few features of its own. Enterprising businesspersons, middle managers, scientists and general computer users of tomorrow should all be pleased with NEC's results.

The complete system, which arrived from Japan in four cardboard boxes, included a NEC PC-8001 Personal Computer, a NEC PC-8011 Expansion Unit, a NEC PC-8031 Mini Disk Unit and a stylish NEC PC-8043 RGB (Red, Green, Blue) Video Monitor. The system is beige-colored (similar to the Spinwriter) with the keyboard surrounded by a brown panel. All necessary cables were included in the cartons. My first impression was favorable. So far, so good.

Components of the PC-8001 stack easily. The expansion unit is below the disk drives. All cable connections are made from the rear panels.

System Overview

The system I reviewed is probably a prototype and most likely won't be identical to the version ultimately released in the U.S.A. For example, the keys are marked in both English and Japanese; most of the peripheral connectors are also marked in Japanese. The markings weren't really handicaps in the initial set-up, but did prove to be an interesting cryptographic exercise.

Each of the four system components has its own ac cable indicating that each unit contains its own power supply. On the rear panel of the PC-8011 Expansion Unit, there are two unswitched ac power outlets allowing the entire system to be run from two wall outlets. A ribbon cable goes between the computer and the expansion unit; another runs between the expansion unit and the mini disk unit, and a video cable goes between the computer and the monitor.

At least, that appeared to be the order of things. As all of the supplied manuals were in Japanese, however, I couldn't be sure of having everything plugged in correctly. The problem was resolved with a few quick phone calls to the people who are translating the manuals into English. Armed with this knowledge, the connectors were plugged in, the "System Disk" diskette was inserted in the drive, and the system powered up.

"DISK VERSION.....How many files (0-15)?" the video asked in large, white upper- and lowercase characters

I pressed RETURN and was informed that I was in "NEC PC-8001 BASIC Ver 1.0 Copyright 1979 (C) by Microsoft." Everything seemed to be working properly.

N-BASIC was developed for the PC-8001 by Microsoft. NEC's selection of a Microsoft BASIC is an intelligent choice since Microsoft BASIC is the industry standard for the moment. The availability of supporting software is justification enough for this selection.

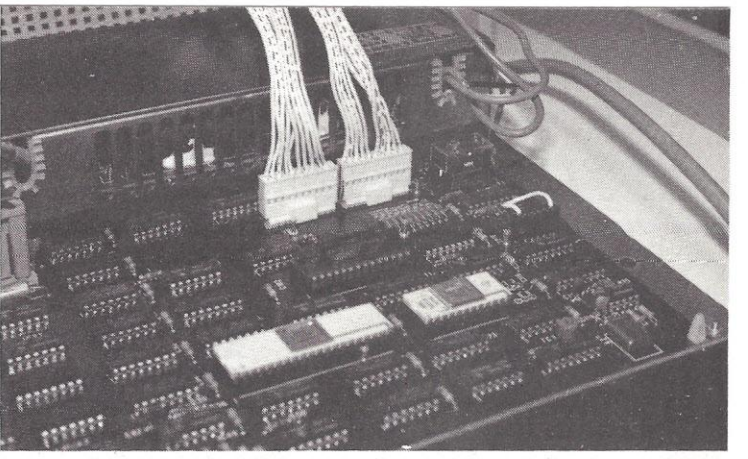
The Computer

The PC-8001 Personal Computer unit is a stand-alone system. When disconnected from the expansion interface, the 8001 comes up in N-BASIC and I deduced that the BASIC is in ROM inside the main unit. When connected to a disk drive, the Disk Operating System is activated upon powering up the machine. The PC-8001 is driven by a NEC Z-80 equivalent known as the μPD780 running at 4MHz; a wise choice since there is a lot of Z-80 software availabe.

Both the appearance and design of the 8001 are appealing. The housing is half pressed-foam and half metal; and the full-size, N-key, rollover keyboard feels durable. The keyboard layout is similar to that of a standard typewriter with additional special keys highlighted in an olive color. The special keys include the ESCape and ConTRol keys, a SHIFT on either side of the space bar, a STOP key, a RETURN key, a GRaPHics key, and a mysterious key with two unknown Japanese symbols on it. (This last key turned out to be a character set switch which, when depressed, causes the display to show Greek characters! The presence of the Greek characters reinforces my belief that the system isn't a standard production model.)

Five programmable function keys, labeled f-1 to f-5, are included along the top of the keyboard. The keys can serve ten functions: five functions when unshifted and five functions when the shift key is used simultaneously. In the review system, the keys were programmed to print immediate commands on the video screen. Some commands are terminated with a carriage return and some are not. The latter require you to press RETURN before a function is called. For instance, one of the keys was programmed to print the string TIME$. By entering a "?," followed by pressing the key marked TIME$ and then pressing RETURN, the computer displays the status of the real time clock. Other pre-defined functions include LIST and RUN. In some screen modes, titles for the special function keys are displayed at the bottom of the screen; when the shift key is pressed, the second level of function keys is displayed.

The NEC people evidently did some homework to find out what features consumers wanted (but couldn't find in other personal computers) and they then proceeded to build those features into the PC-8001. The programmable function keys, useful in both program development and execution because they give you the ability to alter program states easily, are good examples. The keys eliminate the need to memorize complex and troublesome key sequences.

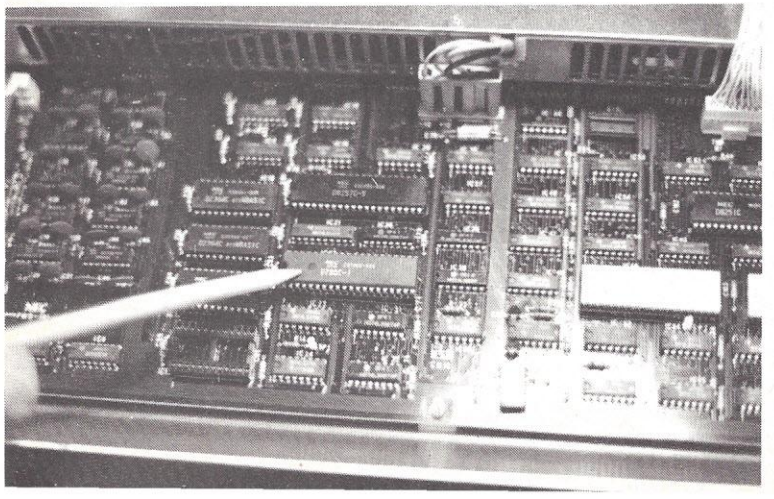


The independent power supply for the PC-8011 Extension Unit is located at the top of this photo. Open up any of the NEC chassis and the view of the power supplies will be the same.

Next to the standard keyboard layout sits a 16-key calculator-style, numeric keypad. Above the keypad are four, olive-colored keys: two control the four directions of cursor movement; the other two are marked HOME/CLR and INS/DEL. The keyboard design seems well suited to high speed typing and on-screen editing.

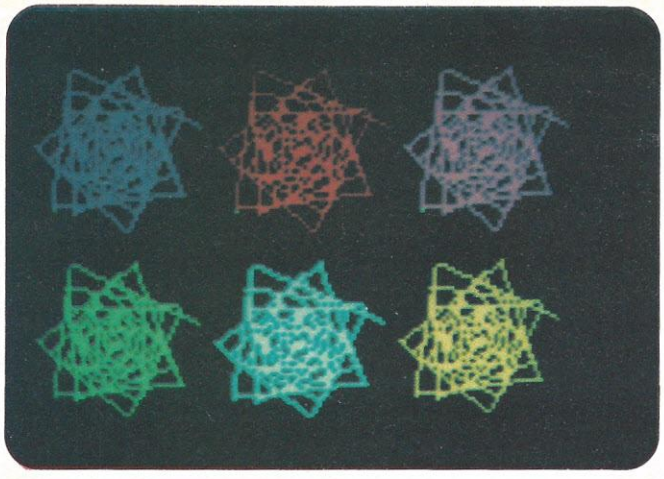
The standard unit comes supplied with 24K ROM (expandable to 32K) and 16K RAM (expandable to 32K). Features include a 600 baud cassette interface, a standard Centronics-type parallel interface, and a TTL-level serial interface (4800, 2400, 1200, 600, 300 baud), all of which are accessible at the rear panel. There are also two video interfaces: one is designed to connect directly with the NEC monitor; the other is a connector for the NEC PC-8044 rf Modulator, which conveniently allows you to use the system with any standard home color (or B&W) television. I tried using a television as the video display but the results were unimpressive when compared to the technologically superior NEC R.G.B. monitor. The strikingly sharp displays of the NEC monitor will be hailed by anyone who sits in front of a computer terminal frequently. An R.G.B. type of monitor maintains independent control over the red. blue and green guns in the CRT. The video circuitry in the PC-8001 is configured around NEC's own μPD3301D CRT controller. The result is one of the most impressive video displays available on a microcomputer today.

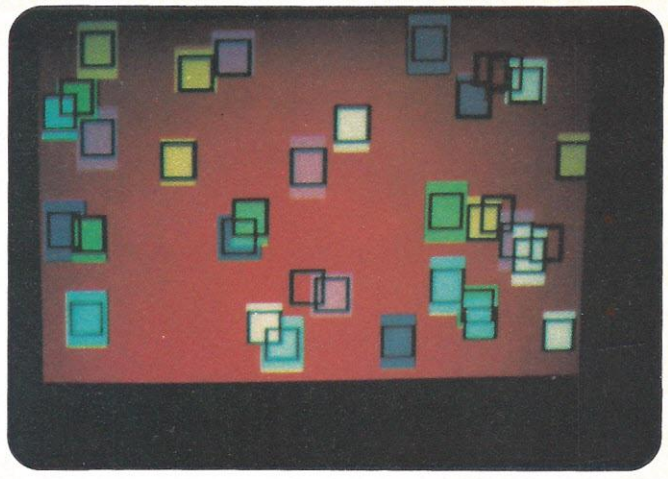
The pencil is pointing to the heart of the computer, the uPD780 which is NEC's verisn of the Z-80. The well-designed board is relatively dense but avoids the clutter of some personal computers.

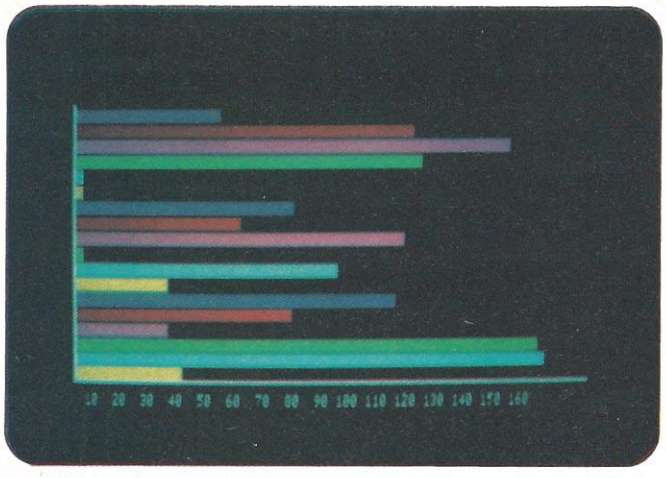


The Expansion Interface and Disk Unit

The PC-8001 (as mentioned earlier) connects via a single ribbon cable to the PC-8011 Expansion Unit. Packed full of features, the 8011 measures approximately 17″ × 11.5″ × 3″ and weighs 4.5kg. Built-in featues include space for an additional 32K of RAM (allowing the expansion of the 8001's memory map to 64K RAM), four additional ROM sockets, two serial interrupt-driven (RS-232C) I/O channels, a floppy disk controller port, four parallel I/O ports, (8 bit and 4 bit In and Out), an IEEE-488 (GPIB) interface, an I/O bus connector and a real time clock. The base dimensions are identical to the Mini Disk Unit, allowing you to stack the components in contemporary, table-top, computer style. The 8031 disk drive unit contains a pair of 5.25″ mini-floppy the 8011 with a single ribbon connector.







Hi-Res color capabilities of the NEC's R.G.B. monitor are impressive. With more direct keyboard control of the monitor's color facilities, complex color graphics are a breeze to generate.

The disk drive unit houses its own dedicated microprocessor and can therefore be classified as "intelligent." The drives themselves are 143KByte, single-sided, double-density units. Facilities are included to add a second pair of disk drives, and in fact, NEC offers a second pair as the PC-8032 Expansion Dual Mini Disk Unit. All of the disk functions take advantage of NEC's own uPD765C Disk Controller chip.

I removed the outside cover of both the expansion unit and the keyboard unit for a closer look. As can be seen in the photos, the circuit boards are well designed and are accompanied by a modular power supply. The kind of quality that I came to associate with the *Spinwriter* is retained in the PC-8001.

N-BASIC

The PC-8001 has two modes of operation; "BASIC" and "terminal."

In the "terminal" mode, the 8001 acts like a non-protocol terminal that, with the addition of an optional RS-232C cable, can be connected to a modem to permit the use of the 8001 as a terminal on another computer or time sharing system. With the ever-increasing accessibility to time sharing systems via personal computers and the increasing popularity of microcomputer cluster systems, a new computer's chances for success could be tied to its ability to perform as a terminal. The "BASIC" mode allows you to use the system to be used as stand-alone, personal computer.

N-BASIC demonstrates outstanding features with 86 commands and statements and 41 functions. Arithmetic is available in integer, floating-point, octal and hexadecimal modes to a maximum of 16 significant figures. Although all of the impressive features of Microsoft BASIC are resident in N-BASIC , I couldn't help but feel that the language is slow. Somehow I expected a Z-80 running at 4MHz to be impressively fast, but it isn't. As soon as there is a good assembler generally available for the PC-8000 series, however, I'm sure we'll see some fireworks.

Perhaps the most attractive feature of the PC-8001 is its color and graphics capabilities. Simple commands set up color registers, allowing color control over any of the points on the screen (160 by 100). Eight colors are available: black, blue, red, magenta, green, cyan, yellow and white. Dot and line drawing is relatively simple using N-BASIC. A full set of graphics characters is available directly from the keyboard when the GRaPHics key is depressed. Graphics and text can be freely interspersed on the screen, and text size can be controlled through software. Using the WIDTH command, the screen can be set to display 36, 40, 72 or 80 characters per line and 20 or 25 lines per screen. Other graphics functions include REVERSE, BLINK and SECRET. (It would take too much space and time to fully explain these features). The CONSOLE command lets you define the scrolling window dimensions. In this way, one section of the screen can be made to remain stationary, while another is changing.

When I sat down in front of the 8001 and started to write BASIC routines, it didn't take long to master the powerful screen editor. I haven't seen anything that can manipulate information on a screen as easily as this computer can. The arrow keys located above the keypad control cursor movement. When a key is depressed for longer than a second, it automatically repeats. This feature allows you to move the

Table of N-BASIC Commands

AUTO	CLOAD	CONT	CSAVE
DELETE	FILES	FORMAT	KEYLIST
LFILES	LIST	LLIST	LOAD
MERGE	MON	MOUNT	NAME
NEW	RENUM	REMOVE	RUN
SAVE	SET	TERM	

Table of N-BASIC Functions

ABD	ATN	CDBL	CINT
COS	CSNG	EXP	FIX
INT	LOG	RND	SGN
SIN	SQR	TAN	ASC
CHR$	CVD	CVI	CVS
HEX$	INKEYS$	INPUT$	INSTR
LEFT$	LEN	MID$	MKD$
MKI$	MKS$	OCT$	RIGHT$
SPACE$	STR$	STRING$	VAL
DSKI$	EOF	FPOS	LOC
LOF			

Table of N-BASIC Statements

CLEAR	DATA	DEF	DEFDBL
DEFINT	DEFSGN	DEFSTR	DIM
END	ERASE	FIELD	FOR-NEXT-STEP
GOSUB	GOTO	LET	IF-THEN-ELSE
LSET	ON-GOSUB	ON-GOTO	READ
REM	RESTORE	RETURN	RSET
STOP	SWAP	CLOSE	DSKO$
GET	INPUT	INPUT #	INPUT #-1
KILL	LINE INPUT	LINE INPUT #	LPRINT
LPRINT USING	OPEN	OUT	POKE
PRINT	PRINT USING	PRINT #	PRINT #-1
PUT	WAIT	COLOR	CONSOLE
GET @	LINE	LOCATE	PRESET
PSET	PUT @	WIDTH	BEEP
ERROR	KEY	MOTOR	ON-ERROR
TRON	TROFF	RESUME	

Table of Features

CPU	: uPD-780C-1 (Z-80 compatible), 4Mhz
ROM	: 24K Bytes (expandable to 32K)
Casette Interface	: FSK system (1200, 2400Hz), 600 baud.
Printer Interface	: Standard Centronics compatible.
Keyboard	: N-key rollover with complete upper/lower case capabilities, numeric keypad and special function keys.
Serial Interface	: TTL-level serial interface using 4800,2400,1200,600 and 300 baud rates.
Power Supply	: AC 120V 50/60Hz, 20W
Dimensions	: 430mm x 260mm x 80mm
Weight	: About 4Kg.

The PC-8001's keyboard is a full-size model with a convenient layout. The 16-key numeric keypad is visible at right, and the special function keys occupy the top row of the main keyboard.

cursor anywhere on the screen with a minimum of key strokes. INSert or DELete functions can then be used to edit, append or delete a particular line. The addition of AUTO, DELETE and RENUM commands simplify editing and reduce programming time.

One of the system's features that I find particularly interesting is the method used to memory map the PC-8011 Expansion Unit onto the processor. Apparently there are four modes of operation, numbered 0 through 3. These modes are set up as follows:

Mode 0: All of the memory within the PC-8001 is active; none of the memory in the PC-8011 is active. BASIC will run in this mode.

Mode 1: The first ROM in the PC-8001 is disabled. The ROM area of the PC-8011 will occupy this memory space. BASIC will not run in this mode.

Mode 2: All of the ROM in the PC-8001 is disabled and replaced by the 32K RAM of the PC-8011. BASIC will not run in this mode.

Mode 3: The fourth ROM in the PC-8001 is disabled. In its place will be the ROM area in the PC-8011. BASIC will run in this mode.

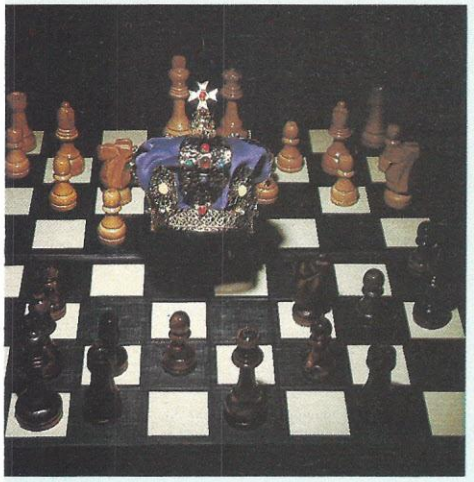
The four modes are selectable either by setting DIP switches or through software (via the OUT command). This mode arrangement makes a versatile bank switching system, giving you the flexibility to switch between languages or operating systems as desired.

Summary

The Japanese invasion has indeed begun. As of yet, no definite price and formal release date has been indicated for the PC-8001. I do know that the system is available in Japan and NEC plans to woo the American marketplace.

Since the 8001 is powered by a Z-80 equivalent, we will undoubtedly see a CP/M operating system for it which will allow the unit to run an abundance of business software already available for CP/M systems. The PC-8001 is more of a business computer than a game machine though I don't want to suggest that you can't have fun with the unit. The lack of game paddles and the professional packaging, however, indicate that this computer is meant more for the office of the future than it is for home or hobbyist.

NEC has an outstanding record and its PC-8000 line is in character with its other products. Once again, it appears the company has designed a winner. □



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MAILING LIST (Tru-Data Software) Lists addresses, prints labels, allows for alterations and deletions, and has the capacity to make duplicate data file disks. Can only be used with version 1.5. *05713, Heath tape, $49.95*

ENGINEERING Software Designs

MCAP: A Microcomputer Circuit Analysis Program (Savon) Performs a linear voltage, impedance, or transfer impedance analysis of an electronic circuit. *04501, PET; 04503, TRS-80 Level II; 04504, Apple II; each tape $24.95; 04513, Heathkit/Zenith Disk, $29.95*

ENGINEERING MATHEMATICS-1 (Gilder) Contains eight programs useful to the engineer: 1. Solving Simultaneous Equations 2. Evaluation of a Polynomial 3. Quadratic Equations 4. Integration by Simpson's Rule 5. Newton-Raphson Roots 6. Derivative of a Function 7. Factorial of a Given Number 8. Extended Factorial Calculation. *01301, PET; 01303, TRS-80 Level II; 01304, Apple II; each tape $14.95*

MICROCOMPUTER AIDED DESIGN OF ACTIVE FILTERS (Gilder) Eight programs that simplify the design of active filters and will calculate the component values needed for various bandpass, low-pass, and notch-type filters. *01401, PET; 01403, TRS-80 Level II; 01404, Apple II; 01407, Heath; each tape $16.95; 01413, Heathkit/Zenith Disk Version, $21.95*

EDUCATION Software Made To Order

CROSSBOW (Breitenbach) Features a target game that, besides offering hours of fun, teaches fractions in an exciting and competitive environment. An educational program for all ages. *02701, PET tape, $9.95*

THE FIRST BOOK OF KIM, 3 Tapes (Butterfield, Ockers, and Rehnke) Three cassettes featuring 28 recreational and 13 utility and diagnostic programs. *00700, KIM-1* (14 recreational programs); *00800, KIM-1* (14 recreational programs); *00900, KIM-1* (13 utility programs); *each tape $9.95*

MICROTYPING (Engel) Features the "touch method" of learning to type for improving your computer skills. *02401, PET; 02403, TRS-80 Level II; 02404, Apple II; each tape $10.95*

GENERAL MATHEMATICS-1 (Gilder) Contains 15 programs useful to anyone who wants to improve their math skills and accelerate their computation. The fifteen programs are: 1. Log to Any Base 2. New Coordinates 3. Rectangular/Polar Coordinates 4. Permutations 5. Combinations 6. Vector Cross-Products 7. Vector Scalar Products 8. Max/Min Locator 9. Number Rounder 10. Dimension Scaler 11. Histogram 12. Circle Finder 13. Nth Root of a Number 14. Normally Distributed Random Numbers 15. Rational Fractions. *01101, PET; 01103, TRS-80 Level II; 01104, Apple II; 01105, Sorcerer; each tape $14.95*

COMPLEX MATHEMATICS (Gilder) Contains 8 programs that give the user the ability to perform computations of complex numbers in BASIC rather than in FORTRAN. The eight programs are: 1. Absolute Value 2. Complex Addition 3. Complex Subtraction 4. Complex Multiplication 5. Complex Division 6. Nth Roots of a Complex Number 7. Complex Exponential 8. Complex Number to a Real Power. *01201, PET; 01203, TRS-80 Level II; 01204, Apple II; each tape $14.95*

Stay At *HOME* Software

ENERGY MISER (SuperSoft Associates) A complete heating/cooling analysis program for your home or office that will calculate heat loss or gain due to poor insulation, leaky doors and windows, and more. *05601, PET; 05603, TRS-80 Level II; 05604, Apple II; each tape $24.95; 05609, Apple II Disk Version; 05613, Heathkit/Zenith Disk Version; $29.95*

PERSONAL PROPERTY INVENTORY (Southern Systems)
Here's an easy-to-use program that lets you develop, maintain, sort and save an inventory of your personal property. *08903, TRS-80 Level II tape, $14.95*

Software Promotes *GENERAL INTEREST*

SONGS IN THE KEY OF APPLE (Lopatin) Allows you to see and hear your favorite tunes, pre-programmed tunes or music you create (up to 200 notes, including rests, per musical piece). *03304, Apple II tape, $10.95*

SKETCHMODE (Walton) Create computer graphics, modify them, save them, and read them from tape. *03203, TRS-80 Level II tape, $11.95*

KEYNOTE (Microflair Associates) Hear any type of music in slow, medium, or fast tempo. *02903, TRS-80 Level II tape, $9.95*

BIOCURVE (Microflair Associates) Charts your biorhythms against another person's and suggests when you will be in a state of instability and therefore vulnerability. *03103, TRS-80 Level II tape, $9.95*

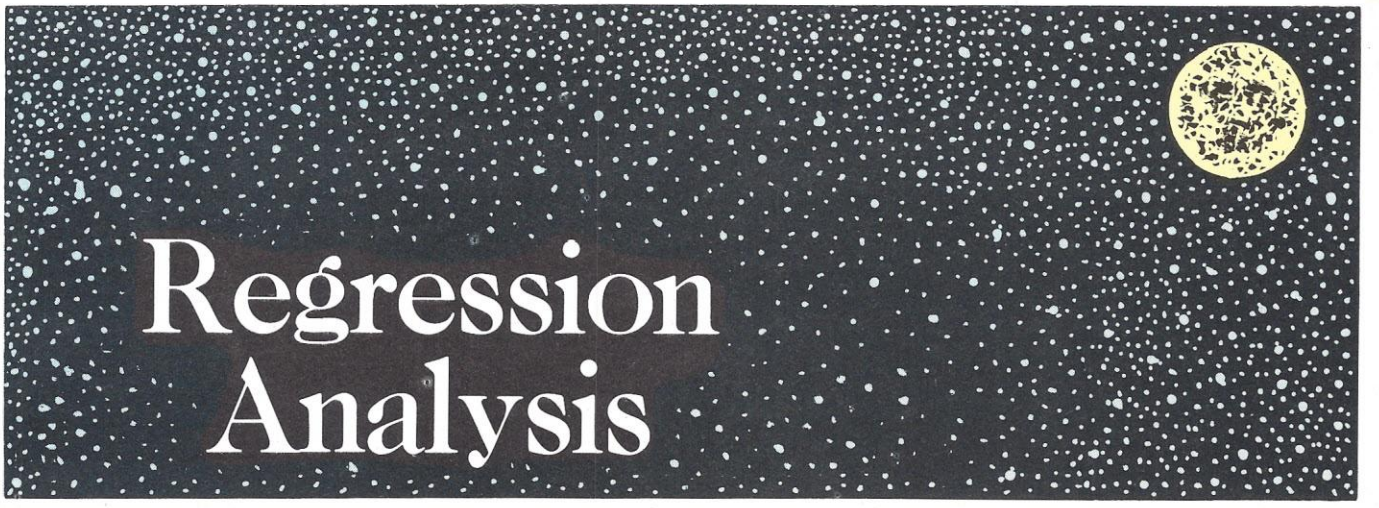
FLASH & CRASH SOUND EFFECTS (American Micro Products)
A collection of 18 subroutines that can be incorporated into your own programs to produce sound effects with the American Micro Products music board. Included are: Train, Explosion, Phaser, Chimes, Sirens, Jet and 12 others.
08709, APPLE II Disk, $39.95

HOW TO BUILD A COMPUTER-CONTROLLED ROBOT (Loofbourrow) Contains 5 control programs that consist of: Joystick Control Program; Self-Direction Program; Impact Sensor Control Routine; and more. *00100, KIM-1 tape, $14.95* Should be used with text **HOW TO BUILD A COMPUTER-CONTROLLED ROBOT**, *5681-8, $9.75*

Hayden software is available at computer stores everywhere.

Hayden
50 Essex Street, Rochelle Park, NJ 07662 Book Company, Inc.

CIRCLE 24



Regression Analysis

BY MIKEL AICKIN

Regression is a statistical and numerical analysis technique for passing lines or planes through clouds of data. The great mathematician Karl Friedrich Gauss is generally credited with the invention of the method of least squares, which underlies the technique of regression. He developed this method to remove, to the greatest extent possible, the errors of observation which inevitably crept into astronomical measurements he was analyzing. Since Gauss' time, regression has become one of the most thoroughly studied methods of data analysis, and has generated a considerable amount of very interesting and useful mathematics.

But the worth of regression is not limited to science. Regressions are used to write equations that express one quantity as a linear function of other quantities, taking into account the past history of how these quantities have been related to each other. Computers are natural aids in these calculations because the computations necessary to carry out a regression are extremely noxious if you do them by hand calculator.

Three Uses of Regression

As I have indicated, one aim of regression is to establish the relationships among scientific quantities. For example, you might want to establish the relationships between the period of a planet's revolution about the sun, on the one hand, and its maximum distance from the sun and orbital eccentricity, on the other hand. Presumably the physical laws which govern matter cause these quantities to be interrelated. Given the nine planets we know of, how can you quantitatively express the relation?

Another aim of regression is to predict the outcome of some future event on the basis of present knowledge. For example, if you are a school superintendent in a rapidly growing district, you might want to predict the number of children that will appear in your schools next autumn. You would already know the number and distribution of new dwellings in your district by keeping in contact with real-estate developers. It seems reasonable that you could use what you have learned about the relation between numbers of dwelling units and numbers of children in the past to help you forecast your enrollments.

A third aim is to control some process by manipulating variables which have a cause-and-effect relationship. For example, I am interested in controlling the pH in my swimming pool, which I generally do by adding muriatic acid at various times. I believe that the pH is also influenced by the outside temperature and the amount of chlorine I add. If I could establish the relationship of pH to these factors, then I could determine how much acid to add to produce the desired pH level.

Understanding a regression equation is much easier than figuring out a cake recipe; in fact, you can think of a regression as a recipe because it specifies how some ingredients go together to produce something. In the example of my pool pH, let Y stand for the pH tomorrow, A stand for the temperature tomorrow, B stand for the pH today, C for the chlorine level today, and D for the amount of acid I add today. I will know B, C and D, and I can use the weather forecast to predict A. A regression equation looks like this:

$$Y = z + aA + bB + cC + dD$$

where z, a, b, c and d are constants and A, B, C and D are the values I have today. Once I know z, a, b, c and d, then I know from the above recipe what value of Y will result. To control the pH tomorrow, I plug in the values of A, B, C and Y into the regression equation and solve for D, the amount of acid I should add.

In the school district example, let Y be the number of children who will enroll next year, A be the number of houses in high-density neighborhoods, B be the number of houses in low-density neighborhoods, and C be the number of apartments. Then I could write:

$$Y = z + aA + bB + cC$$

so that as soon as I know the values of z, a, b and c, I can plug in A, B and C (obtained from the developers and my past records) and predict Y.

In the planetary example it is reasonable to take Y as the log of a planet's period of revolution, A as the log of its maximum distance from the sun, and B as the log of its orbital eccentricity. The regression equation is:

$$Y = z + aA + bB$$

On the basis of the known values of Y, A and B for the nine planets in our system, regression analysis will help find the values of z, a and b.

Least Squares

In order to get an idea of what the regression problem is, suppose you have some data on hand. This means that on n occasions numbered 1 to n you have recorded the values of Y, A, B, . . .which actually occurred. For the purposes of notation let Y(i) be the i-th observation of Y, A(i) be the i-th observation of A, and so on. Now write down the equations:

$$Y(1) = z + aA(1) + bB(1) + cC(1)$$
$$Y(2) = z + aA(2) + bB(2) + cC(2)$$

.
.
.

Illustrated by Josh Randall

$Y(n) = z + aA(n) + bB(n) + cC(n)$

You know the values of the capital letters in these equations, since they are the values you observed, and the problem is to find the values of the lower case letters. There are two possibilities: 1. There are solutions to the above equations. 2. There are no solutions to the above equations.

Strange though it may sound, regression is really only concerned with case 2. The reason is that in case 1 there are generally many solutions, and you have no way of knowing which to choose. Or, you have not taken enough observations to be able to say what the values z, a, b and c are. In case 2 you have an abundance of information in the observations that you have made, but because of errors in the data the above equations are almost but not quite solvable.

The basic idea behind least squares is to find the values of z, a, b and c which come as close as possible to solving the equations. That is, for a particular set z, a, b and c define:

$W(i) = z + aA(i) + bB(i) + cC(i)$

for i running from 1 to n, and then measure how close you came to solving the equations with the quantity:

Sum of all $[Y(i) - W(i)]^{**}2$ for i = 1 to n

Keep trying different values until you find ones that minimize the above expression. It's amazing that this problem is not as hard as it sounds, and there is a unique set z, a, b and c that almost always minimize the above sum of squares. The solutions z, a, b and c of the least squares problem are called the regression coefficients, and the fact that they are unique is quite important; if there were several solutions you would have no way of choosing among them.

UPDATE and SWEEP Algorithms

To compute the regression coefficients from the data it is necessary to compute some intermediate values. The first of these are the means of all the variables. For example, the mean of Y is defined by:

M = [Sum of all Y(i)]/n

We also need the sums of products of all pairs of variables. For instance, if M is the mean of A and N is the mean of B, then the sum of products of A and B is defined by:

S = Sum of all [A(i) − M] * [B(i) − N]

In order to compute these values it looks as though two passes through the data will be necesary, the first to compute all means and the second to compute all sums of products. With the UPDATE algorithm, you'll do it in one pass. Consider the mean, M, of Y. Let M(k) denote the mean of Y computed from just the first k observations. Then algebraically:

$$M(k+1) = M(k) + (Y(k+1) - M(k))/(k+1)$$

Thus, you can get M(k+1) from knowing just M(k) and Y(k). Similarly, letting S(k) stand for the sum of products of A and B computed on just the first k observations, it is algebraically true that:

$$S(k+1) = S(k) + (A(k+1) - M(k)) * (B(k+1) - N(k)) * k/(k+1)$$

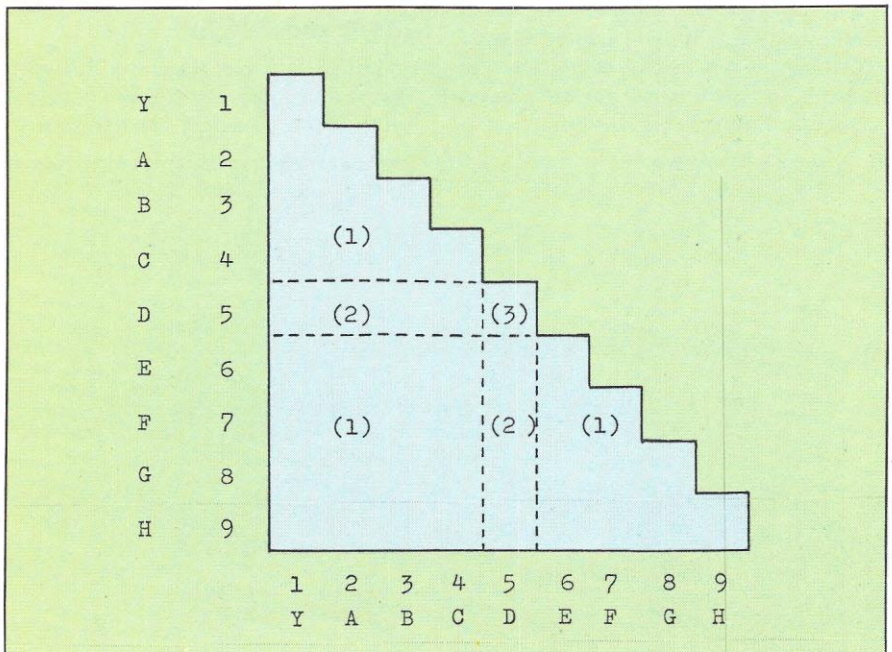


Figure 1. Diagram of the S-array. The dotted lines show the regions of the array to which the parts (1), (2) and (3) of the SWEEP algorithm apply, for SWEEP I = 5.

where M(k) and N(k) here stand for the means of A and B computed from the first k observations. You can get S(k+1) from knowledge of S(k), M(k), N(k), A(k+1) and B(k+1). You can detect the use of UPDATE in lines 620 and 650 in the program listing.

Incidentally, for the sort of data sets you'll probably run across, the savings in time by using a one-pass rather than two-pass algorithm will probably be negligible. However, there is another benefit from UPDATE — it doesn't produce the round-off errors which plague least squares programs, even ones on large computers written in Fortran with multiple precision arithmetic. It is doubly useful for the not-so-accurate arithmetic of many microcomputers.

To discuss the SWEEP algorithm it is useful to change the notation to make it correspond more closely to the actual Basic listing. Think of the variables Y, A, B and so on, as being numbered, Var 1 being Y, Var 2 being A, and so on. Thus M(1), M(2), . . .will be the means and S(1,1), S(1,2), S(2,2), . . .will be the sums of products. The S-array appears as in Figure 1. We only need to save the values S(I,J) for the cases J <= I, since S(I,J) = S(J,I), and this is why the array is triangular rather than rectangular.

The SWEEP algorithm specifies certain operations to be performed on the S-array which result in the values of a, b, c and so on appearing in the first column of the array. These operations are the equivalent of a matrix inversion. The algorithm says:

For each I = 2 to L

1. Replace each S(J,K) by S(J,K) − S(J,I) * S(I,K)/S(I,I) whenever J <> I and K <> I.
2. Replace each S(I,J) by S(I,J)/S(I,I), and each S(J,I) by S(J,I)/S(I,I).
3. Replace S(I,I) by −1/S(I,I)

where L is the number of variables. The properties of the algorithm are such that at the end of the computations:

1. S(1,1) contains the sum of squared errors which has been minimized.
2. S(I,1) contains the regression coefficient of Var 1, for I = 2 to L.
3. z is equal to M(1) minus the sum of the products of each regression coefficient times its variable mean.

Thus in the original notation, if L = 4 you have:

1. S(1,1) = sum of $(Y(i) - W(i))^{**}2$
2. S(2,1) = a, S(3,1) = b, S(4,1) = c
3. z = M(1) − a * M(2) − b * M(3) − c * M(4).

This statement of the algorithm uses I and J symmetrically, but since you only intend to store S(I,J) for J <= I, in the coding you have to allow for this.

Using the Program

See Figure 2 for a block structure diagram of the program. The real meat of the program is in the UPDATE and SWEEP algorithms. How you feed the data into the program and output the results will have a lot to do with your system configuration, and the power of the Basic implementation. To use the program you must fill in or modify the indicated blocks with the code that accomplishes these things for you.

Each case, numbered I = 1 to N, consists of Y(I), A(I), B(I), and so on, for one observation. These values are entered at line 430. In the block beginning at 305 you might OPEN a file which contains the data, and thus 430 would be modified to INPUT the data from the specified file. Or, you could store the data in DATA statements after 305 and then 430 would be changed to READ.

In the block beginning at 505 you can modify the data. For example, in the planetary data example the data file might contain the period, distance and eccentricity. Here, you should take the logarithms of these quantities.

In the block beginning at 1006, print out the regression coefficients (use an attractive format).

Keep in mind that the Y variable is always assumed to be variable 1. Another handy relation to remember is that the S-array is actually stored as a linear array, not a rectangular one. The value which I've been calling S(I,J) for J <= I would appear in location I(I−1)/2+J of the S-array in the program. For example, the regression coefficient of variable I is located at position I(I−1)/2+1.

Since the SWEEP algorithm performs division by S(I,I), how can you make sure that this quantity is not zero? As it turns out, if in fact S(I,I) = 0 then variable I can be written as an exact linear combination of the variables 2,3, . . .,I − 1. Consequently, there are many values of a, b, c and so on, which minimize the sum of squared errors. Thus S(I,I) = 0 is a warning that the regression equation has not been set up correctly. Notice that this condition is tested at line 730 and the program branches to an error exit with the appropriate message. When this happens, variable I must be deleted from the regression equation.

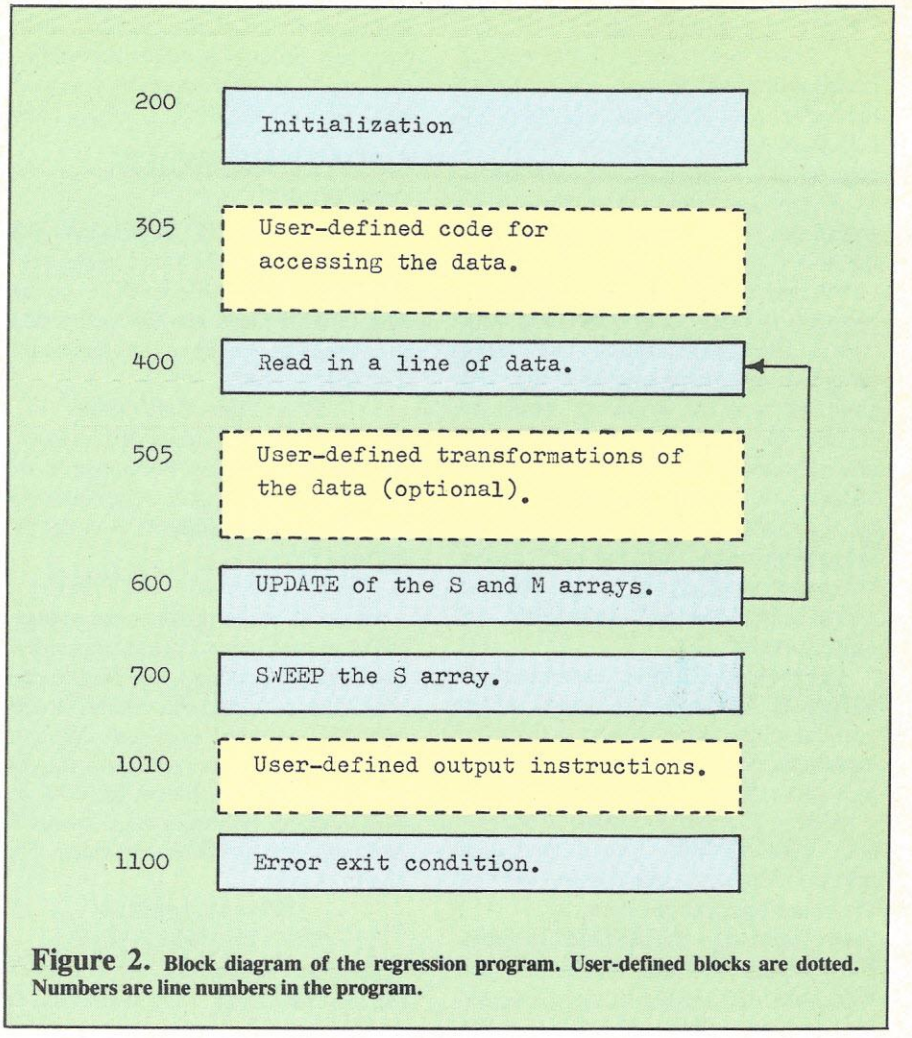


Figure 2. **Block diagram of the regression program. User-defined blocks are dotted. Numbers are line numbers in the program.**

Input and Output

In Figure 3 you'll see the changes to the basic program which are necessary to read the planetary data from a file

Figure 3

```
0304 OPEN "PLANET.DAT" AS FILE 7
0305 INPUT #7,N,L
0430       INPUT #7,X(J)
0505    FOR J = 1 TO L
0506       LET X(J)=LOG(X(J))
0507    NEXT J
1006 LET Z=M(1)
1007 FOR I = 2 TO L
1008    LET J=I*(I-1)/2+1
1009    PRINT I-1,S(J)
1010    LET Z = Z - S(J)*M(I)
1011 NEXT I
1012 PRINT "MEAN",Z
```

Figure 4

```
0305 LET N=8
0306 LET L=4
0310 DATA 1045,253,107, 25
0311 DATA 1382,307,121, 48
0312 DATA 1645,350,140, 67
0313 DATA 1868,383,150, 67
0314 DATA 1845,421,167, 70
0315 DATA 2202,532,200,117
0316 DATA 2467,550,225,213
0317 DATA 2708,583,254,231
0430       READ X(J)
1010 LET Z=M(1)
1015 FOR I=2 TO L
1020    J=I*(I-1)/2+1
1025    PRINT I-1,S(J)
1030    LET Z=Z-M(I)*S(J)
1035 NEXT I
1040 PRINT "MEAN",Z
```

Figure 5

```
0305 LET N = 10
0306 LET L = 5
0310 DATA 7.32, 96,7.40,6,0
0311 DATA 7.55,101,7.32,5,1
0312 DATA 7.12,105,7.55,6,0
0313 DATA 6.83,104,7.12,7,2
0314 DATA 7.17, 98,6.83,5,3
0315 DATA 7.42, 99,7.17,5,2
0316 DATA 7.49,100,7.42,6,2
0317 DATA 7.39, 95,7.49,6,1
0318 DATA 7.47, 92,7.39,6,2
0319 DATA 7.29,101,7.47,7,2
0430       READ X(J)
1010 LET Z=M(1)
1015 FOR I=2 TO L
1020    J=I*(I-1)/2+1
1025    PRINT I-1,S(J)
1030    LET Z=Z-M(I)*S(J)
1035 NEXT I
1040 PRINT "MEAN",Z
```

Planet	Y	A	B
Mercury	.241	.459	2.513
Venus	.615	.716	.086
Earth	1.000	1.000	1.000
Mars	1.881	1.639	1.142
Jupiter	11.861	5.365	.587
Saturn	29.453	9.906	.685
Uranus	84.002	19.767	.575
Neptune	164.763	29.825	.144
Pluto	248.390	48.703	3.007

Table 1. **Data for the planetary example. Y is the period of revolution, A the maximum distance from the sun, and B the eccentricity of the orbit, all relative to an Earth value of 1.**

Year	Y	A	B	C
1972	1045	253	107	25
1973	1382	307	121	48
1974	1645	350	140	67
1975	1868	383	150	67
1976	1845	421	167	70
1977	2202	532	200	117
1978	2467	550	225	213
1979	2708	583	254	231

Table 2. **Data for the school district example. Y is the number of students, A is the number of houses in high-density neighborhoods, B the number in low-density neighborhoods, and C the number of apartments.**

Y	A	B	C	D
7.32	96	7.40	6	0
7.55	101	7.32	5	1
7.12	105	7.55	6	0
6.83	104	7.12	7	2
7.17	98	6.83	5	3
7.42	99	7.17	5	2
7.49	100	7.42	6	1
7.39	95	7.49	6	1
7.47	92	7.39	6	2
7.29	101	7.47	7	2

Table 3. **Data for the swimming pool example. Y is the pH tomorrow, A the temperature today, B the pH today, C the chlorine today, and D the amount of acid I add today.**

called PLANET.DAT, and the output instructions for displaying the results of the computations. The values of the variables appear in Table 1, with all variables rescaled so that the values for Earth are all 1. The fitted regression is:

$$Y = -.112 + 1.493*A - .082*B$$

The third law of planetary motion says that the coefficient of A should be 1.5; there is a good agreement between theory and data. This law also implies that the coefficient of B should be zero, also closely approximated by the regression.

The modifications for the school district data (Table 2) are shown in Figure 4. Retain the output modifications from the preceding run here. The regression is:

$$Y = 113.75 + 2.5*A + 3.9*B + .57*C$$

It turns out for 1980 that A = 595, B = 302 and C = 257. Plugging these values into the equation, I predict Y = 2927 students next year.

The data for my pool is in Table 3, and the program modifications are in Figure 5. The regression is:

$$Y = 2.493 - .015*A + 1.025*B - .238*C + .12*D$$

If the next day's temperature were predicted to be A = 100, and the chlorine level were C = 6, and we know B = 7.29, by plugging these values in I get:

$$Y = 7.017 + .12*D$$

If I want to have Y = 7.5 tomorrow I must add D = 4.02 units of acid.

Please be aware that this program is just an introductory article and the complications which can arise in regression have not been discussed at all. Don't bet any money on the result of a regression prediction until you are a regression expert.

Further Reading

The literature on regression is absolutely enormous, but there are good introductions to the subject in almost any elementary statistics textbook. Here are a few of my favorites:

John Neter and William Wasserman (1974) *Applied Linear Statistical Models*, Homewood, Illinois, Richard D. Irwin, Inc.

Samprit Chatterjee and Bertram Price (1977) *Regression Analysis by Example*, New York, John Wiley and Sons.

James H. Goodnight (1979) *A tutorial on the SWEEP operator, The American Statistician* 33:149-158. □

Program Listing on next page

Program Listing

```
0100 DIM S(210),M(20),X(20)
0200 REM ***  Initialize arrays
0210 FOR I = 1 TO 20
0220    LET M(I)=0
0230 NEXT I
0240 FOR I = 1 TO 210
0250    LET S(I)=0
0260 NEXT I
0300 REM ***  Insert set-up for data here
0301 REM ***  Define N = no. of cases,
0302 REM ***  and L = no. of variables
0305 INPUT N,L
0400 REM ***  Read in data
0410 FOR I = 1 TO N
0420    FOR J = 1 TO L
0430       INPUT X(J)
0440    NEXT J
0500    REM ***  Do transformations here
0501    REM ***  Do not change I
0600    REM ***  UPDATE S and M arrays
0601    FOR J = 1 TO L
0610       LET X(J)=X(J)-M(J)
0620       LET M(J)=M(J)+X(J)/I
0630       FOR K = 1 TO J
0640          LET P=J*(J-1)/2+K
0650          LET S(P)=S(P)+X(J)*X(K)*(I-1)/I
0660       NEXT K
0670    NEXT J
0680 NEXT I
0700 REM ***  Begin SWEEPing
0710 FOR I = 2 TO L
0720    LET T=I*(I+1)/2
0730    IF S(T) = 0  THEN GO TO 1101
0740    REM ***  SWEEP 1
0750    FOR J = 1 TO L
0760       IF J = I  THEN GO TO 860
0770       IF J < I THEN Q=I*(I-1)/2+J
0780       IF J > I THEN Q=J*(J-1)/2+I
0790       FOR K = 1 TO J
0800          IF K = I THEN GO TO 850
0810          LET P=J*(J-1)/2+K
0820          IF K < I THEN R=I*(I-1)/2+K
0830          IF K > I THEN R=K*(K-1)/2+I
0840          LET S(P)=S(P)-S(Q)*S(R)/S(T)
0850       NEXT K
0860    NEXT J
0870    REM ***  SWEEP 2
0880    FOR J = 1 TO I-1
0890       LET P=I*(I-1)/2+J
0900       LET S(P)=S(P)/S(T)
0910    NEXT J
0920    IF I = L THEN GO TO 970
0930    FOR J = I+1 TO L
0940       LET P=J*(J-1)/2+I
0950       LET S(P)=S(P)/S(T)
0960    NEXT J
0970    REM ***  SWEEP 3
0980    LET S(T)=-1/S(T)
0990 NEXT I
1000 REM ***  SWEEP Completed
1001 REM ***  M contains means
1002 REM ***  S(i(i-1)/2+1) for i=2,L contains
1003 REM ***  the regression coefficients
1004 REM ***  S(1) contains error sum of squares
1099 GO TO 1110
1005 REM ***  Insert output instructions here
1100 REM ***  Error exit
1101 PRINT 'VARIABLE';I;'IS A LINEAR COMBINATION '
1102 PRINT 'OF THOSE PRECEDING IT'
1110 STOP
1111 END
```

KING OF THE HILL!

We've taken artistic license with our illustration in order to make a point: MYCHESS is the most powerful microcomputer chess program on the market, bar none.

Proof? All you want and then some. For example, MYCHESS was the winner of the "Fifth West Coast Computer Fair". At the "Third World Computer Chess Championship" in Linz, Austria, it was the highest finishing micro... in addition to winning the special Blitz Tournament (5 to 1) against six top players. Add to this its USCF rating of 1565, and you know you're dealing with the King of the Hill.

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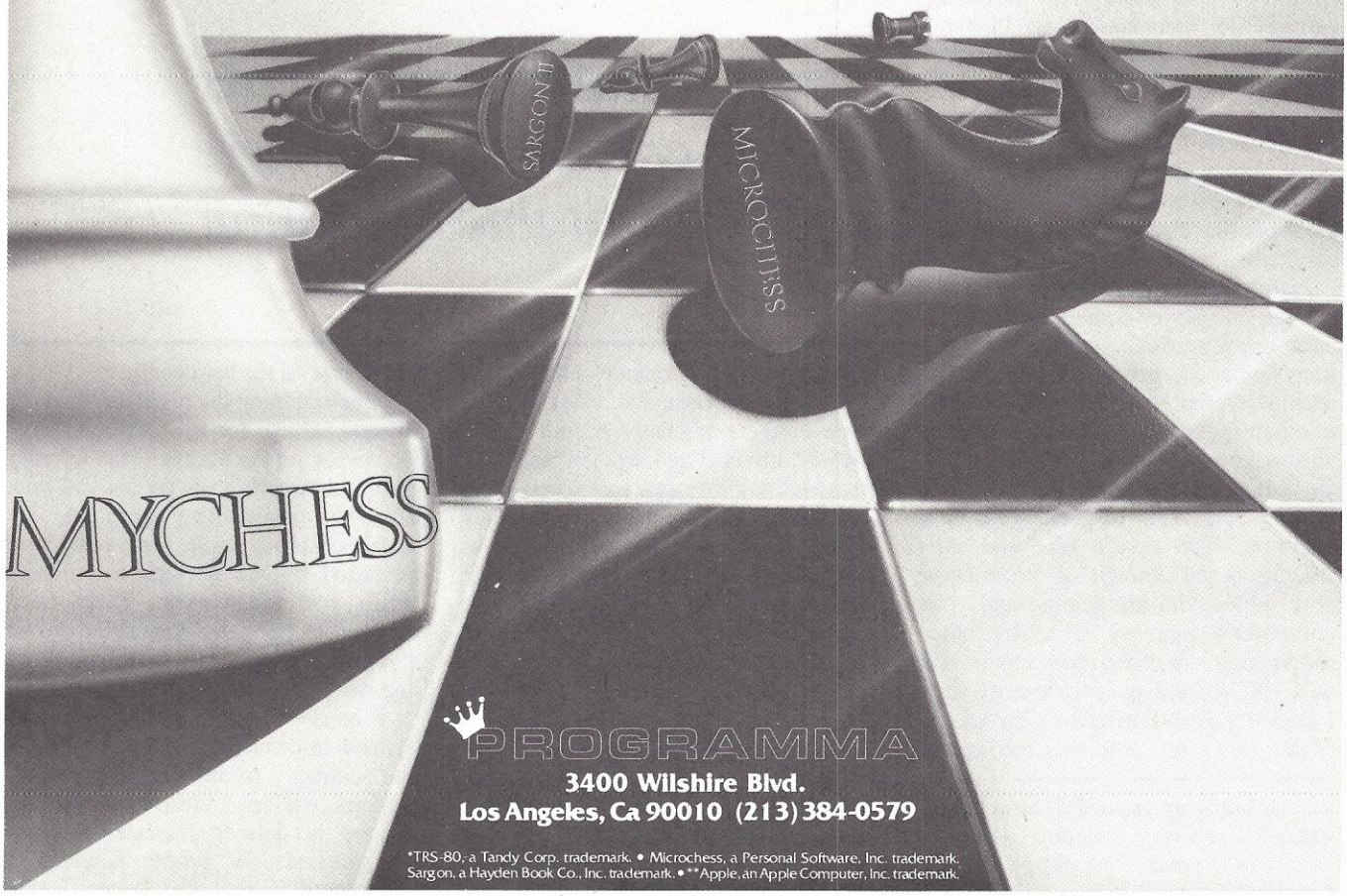

PROGRAMMA

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CIRCLE 66

Delivery Damage Reports

BY CLINT HENTZ

In today's economic environment, it becomes very important for the management of a business to scrutinize every item on the company's operating statement. The listed program helps focus on one expense item appearing on a retail operating statement, namely, delivery damages to merchandise created by the delivery department.

A company that delivers quantities of merchandise to customers via their own delivery trucks incurs delivery costs which effect the operating statement. While some of the delivery department's costs are beyond the direct control of the department manager, damage to merchandise in loading, handling or hauling, is the direct responsibility of the manager. This program was written primarily to assist the delivery manager and the operations manager in tracking delivery damages. Proper investigation of the information produced by the program results in a more profitable operation.

Information in the print-out spells out the number of damages created by each delivery truck, type of damage, item damaged, percent of damages to total deliveries, and highlights the cost to repair the damage. The program also allows you to sort the information by any category. The sort works well and is very applicable to other areas of a business. You should take into consideration the amount of information with which you are dealing and your computer's memory. I utilize other rather long, involved programs on my 48K TRS-80 which incorporate the sort. I find it possible to DIM(175) for ten fields and still sort the records in approximately fifty seconds. It is not as fast as a machine sort I purchased, but the sort in the program is easy to work with.

This program was written on a TRS-80 and saved on a diskette for ease in handling. A Radio Shack tractor-feed line printer is used for the print-out. The printer could be eliminated by changing the LPRINT statements to PRINT, but it permits copies of the information to be distributed to each truck crew, delivery manager and operations manager. I feel it is important to have everyone involved with the problem be aware of the facts.

Perhaps an operation using two or three delivery trucks could use a 16K TRS-80 Level II and save on tape. The program has very few multi-line statements separated by a colon (:) and they all could be made into one line statements. Just remember to watch the GOTO statements if you change line numbers. Depending on the amount of data you are tracking, you may need to change the DIM statements in lines 150 and 160. Of course, you will change the items and the descriptions of the damages to conform to your operation. (See lines 790 to 930).

On the TRS-80, a division by zero error could have been handled with ON ERROR GOTO, but I believe some computers don't have that phrase. I wrote around this in a way that may work on several different makes of computers. Lines 70, 80 and 90 handle the input for the total number of deliveries for each of three trucks. In line 780, P$ is the print format for the PRINT USING statement in line 940. The number (#) sign accommodates numbers while the space between percent signs (% %) handles alphabetic characters on the TRS-80. Some computers use the number sign for both. LPRINT sends the information to the printer and the LPRINT " " creates a blank line on the hard copy.

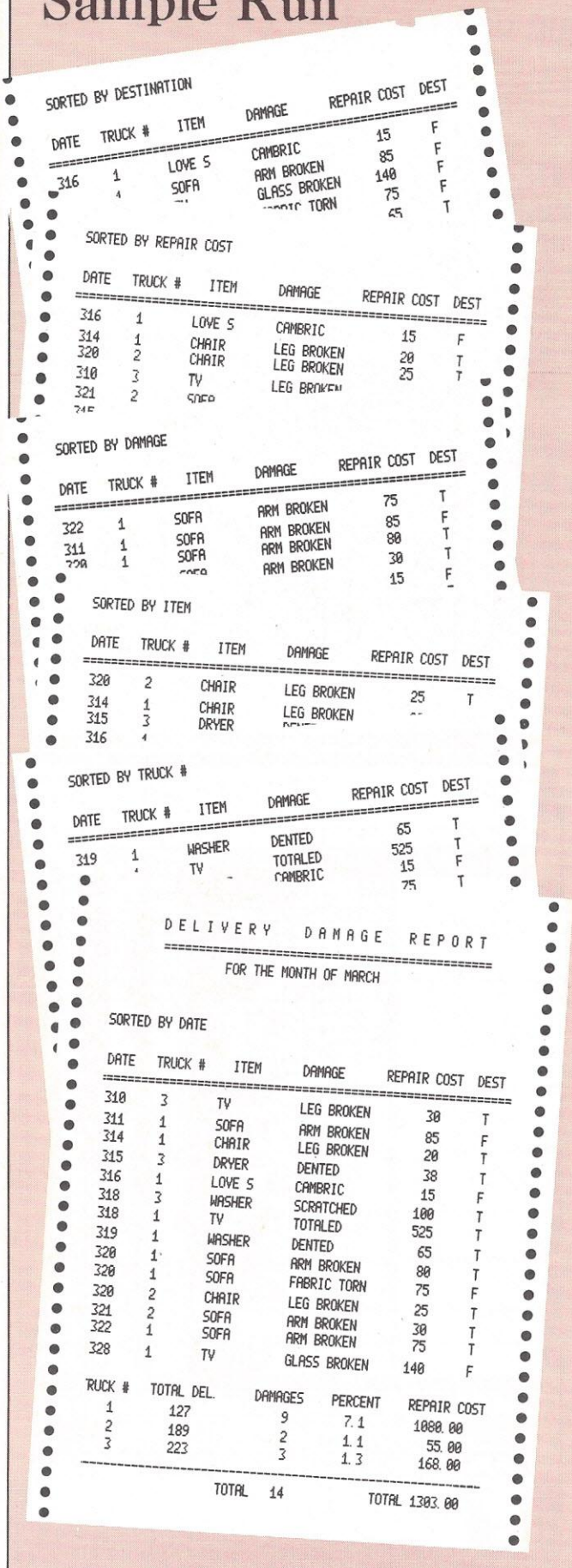
When running the program, lines 70, 80 and 90 ask for the total number of deliveries for each truck. This information is obtainable from the updated route sheets in most delivery operations. The repair costs are taken from worksheets prepared by the persons or company doing the repair work. There are a number of REM statements throughout the program to assist you in understanding what is taking place.

I have found the program and its related information helpful in bringing the damage to the attention of the various delivery crews. It has also helped the delivery manager substantiate requests for proper handling of equipment. ▯

Analyzing printouts can result in a more profitable operation.

Mr. Hentz's previous PC *articles include "Drapery Estimating" (September 1980) and "Tracking Add-On Sales" (November 1980).*

Sample Run



SORTED BY DESTINATION

DATE	TRUCK #	ITEM	DAMAGE	REPAIR COST	DEST
316	1	LOVE S	CAMBRIC	15	F
		SOFA	ARM BROKEN	85	F
			GLASS BROKEN	140	F
			FABRIC TORN	75	T
				65	T

SORTED BY REPAIR COST

DATE	TRUCK #	ITEM	DAMAGE	REPAIR COST	DEST
316	1	LOVE S	CAMBRIC	15	F
314	1	CHAIR	LEG BROKEN	20	T
320	2	CHAIR	LEG BROKEN	25	T
310	3	TV	LEG BROKEN		
321	2	SOFA			

SORTED BY DAMAGE

DATE	TRUCK #	ITEM	DAMAGE	REPAIR COST	DEST
322	1	SOFA	ARM BROKEN	75	T
311	1	SOFA	ARM BROKEN	85	F
		SOFA	ARM BROKEN	80	T
			ARM BROKEN	30	T
				15	F

SORTED BY ITEM

DATE	TRUCK #	ITEM	DAMAGE	REPAIR COST	DEST
320	2	CHAIR	LEG BROKEN	25	T
314	1	CHAIR	LEG BROKEN		
315	3	DRYER			
316	1				

SORTED BY TRUCK #

DATE	TRUCK #	ITEM	DAMAGE	REPAIR COST	DEST
319	1	WASHER	DENTED	65	T
		TV	TOTALED	525	T
			CAMBRIC	15	F
				75	T

D E L I V E R Y D A M A G E R E P O R T

FOR THE MONTH OF MARCH

SORTED BY DATE

DATE	TRUCK #	ITEM	DAMAGE	REPAIR COST	DEST
310	3	TV	LEG BROKEN	30	T
311	1	SOFA	ARM BROKEN	85	F
314	1	CHAIR	LEG BROKEN	20	T
315	3	DRYER	DENTED	38	T
316	1	LOVE S	CAMBRIC	15	F
318	3	WASHER	SCRATCHED	100	T
318	1	TV	TOTALED	525	T
319	1	WASHER	DENTED	65	T
320	1	SOFA	ARM BROKEN	80	T
320	1	SOFA	FABRIC TORN	75	F
320	2	CHAIR	LEG BROKEN	25	T
321	2	SOFA	ARM BROKEN	30	T
322	1	SOFA	ARM BROKEN	75	T
328	1	TV	GLASS BROKEN	140	F

TRUCK #	TOTAL DEL.	DAMAGES	PERCENT	REPAIR COST
1	127	9	7.1	1080.00
2	189	2	1.1	55.00
3	223	3	1.3	168.00
TOTAL	14			TOTAL 1303.00

Program Listing

```
10 REM  DELIVERY  DAMAGE  REPORT  PROGRAM
20 REM       C L I N T   H E N T Z
30 REM        ST. LOUIS, MISSOURI
40 CLEAR 1000
50 INPUT"FOR WHICH MONTH IS THIS REPORT";M$
60 REM    PROGRAM SET FOR 3 TRUCKS
70 INPUT"TOTAL DELIVERIES FOR TRUCK # 1";W1
80 INPUT"TOTAL DELIVERIES FOR TRUCK # 2";W2
90 INPUT"TOTAL DELIVERIES FOR TRUCK # 3";W3
100 LPRINT TAB(8)"D E L I V E R Y    D A M A G E   R E P O R T"
110 LPRINT TAB(8)"=============================================="
120 LPRINT TAB(17)"FOR THE MONTH OF ";M$
130 REM    DIM STATEMENTS TO BE INCREASED IF DAMAGES
140 REM    RUN MORE THAN 100 PER MONTH.
150 DIM N1(100):DIM N2(100):DIM N$(100):DIM N4$(100)
160 DIM N5(100):DIM N6$(100):DIM A(100):DIM A$(100)
170 CLS
180 PRINT:PRINT
190 PRINT"       S O R T  BY"
200 PRINT
210 PRINT"       1 = DATE"
220 PRINT"       2 = TRUCK NUMBER"
230 PRINT"       3 = ITEM OF MDSE."
240 PRINT"       4 = TYPE OF DAMAGE"
250 PRINT"       5 = COST OF REPAIR"
260 REM    #6 IS TO - OR - FROM CUSTOMERS HOME
270 PRINT"       6 = DESTINATION"
280 PRINT:PRINT"     ==========================":PRINT
290 PRINT"      MAKE SELECTION & ENTER"
300 INPUT X
310 CLS
320 G1=0
330 I=1
340 LPRINT"  ":LPRINT"  "
350 IF X=1 LPRINT" SORTED BY DATE"
360 IF X=2 LPRINT" SORTED BY TRUCK #"
370 IF X=3 LPRINT" SORTED BY ITEM"
380 IF X=4 LPRINT" SORTED BY DAMAGE"
390 IF X=5 LPRINT" SORTED BY REPAIR COST"
400 IF X=6 LPRINT" SORTED BY DESTINATION"
410 LPRINT"  "
420 LPRINT" DATE   TRUCK #    ITEM      DAMAGE      REPAIR COST  DEST"
430 LPRINT"=============================================================":PRINT
440 REM    N1(I)=DATE  N2(I)=TRUCK#  N$(I)=ITEM  N4$(I)=DAMAGE
450 REM    N5(I)=REPAIR COST  N6$(I)=DESTINATION
460 READ N1(I),N2(I),N$(I),N4$(I),N5(I),N6$(I)
470 IF N$(I)="9999" GOTO 610
480 REM    G1  ADDS REPAIR COST DOLLARS
490 G1=G1+N5(I)
500 IF N2(I)=1 THEN 520  ELSE 530
510 REM    560-580-600 ADDS TOTALS FOR EACH TRUCK
520 Q=Q+1:Q1=Q1+N5(I):Q3=N2(I)
530 IF N2(I)=2 THEN 540  ELSE 550
540 Q4=Q4+1:Q5=Q5+N5(I):Q6=N2(I)
550 IF N2(I)=3 THEN 560  ELSE 570
560 Q7=Q7+1:Q8=Q8+N5(I):Q9=N2(I)
570 I=I+1
580 N=N+1
590 G=G+1
600 GOTO 460
610 FOR I= 1 TO N
620 REM    NEXT 5 LINES ALLOW FOR INDIVIDUAL SORTS
630 IF X=1 THENA(I)=N1(I):NEXT:GOTO 690
640 IF X=2 THEN A(I)=N2(I):NEXT:GOTO 690
650 IF X=5 THEN A(I)=N5(I):NEXT:GOTO 690
660 IF X=4 THEN A$(I)=N4$(I):NEXT:GOTO 690
670 IF X=6 THEN A$(I)=N6$(I):NEXT:GOTO690
680 A$(I)=N$(I):NEXT
690 K=0
700 I=1
710 FOR J= 2 TO N
```

continued

Delivery Damage Reports Listing continued

```
720 IF (X=1)OR(X=2)OR(X=5) THEN 740
730 IF(X=3)OR(X=4)OR(X=6) GOTO 750
740 IF A(I)<A(J) GOTO 760  ELSE I=J:GOTO 760
750 IF A$(I)<A$(J) GOTO 760  ELSE I=J
760 NEXT
770 IF N%(I)="9999" GOTO 960
780 P$="####    ##       %      %  %          %    ###      % %"
790 IF N%(I)="S" THEN N$(I)="SOFA"
800 IF N%(I)="C"THEN N$(I)="CHAIR"
810 IF N%(I)="T" THEN N$(I)="TV"
820 IF N%(I)="L" THEN N$(I)="LOVE S"
830 IF N%(I)="W" THEN N$(I)="WASHER"
840 IF N%(I)="D" THEN N$(I)="DRYER"
850 IF N4$(I)="L" THEN N4$(I)="LEG BROKEN"
860 IF N4$(I)="A" THEN N4$(I)="ARM BROKEN"
870 IF N4$(I)="S" THEN N4$(I)="SCRATCHED"
880 IF N4$(I)="C" THEN N4$(I)="CAMBRIC"
890 IF N4$(I)="D" THEN N4$(I)="DENTED"
900 IF N4$(I)="F" THEN N4$(I)="FRAME BENT"
910 IF N4$(I)="M" THEN N4$(I)="FABRIC TORN"
920 IF N4$(I)="G" THEN N4$(I)="GLASS BROKEN"
930 IF N4$(I)="T" THEN N4$(I)="TOTALED"
940 LPRINT USING P$; N1(I),N2(I),N$(I),N4$(I),N5(I),N6$(I)
950 IF (X=1) OR(X=2) OR(X=5)THEN A(I)=9999:K=K+1:GOTO 970
960 A$(I)="ZZ":K=K+1
970 IF K=N GOTO 980  ELSE GOTO 700
980 IF S$="Y" GOTO 1090
990 LPRINT"  "
1000 LPRINT"TRUCK #   TOTAL DEL.      DAMAGES    PERCENT     REPAIR COST"
1010 H$="    #        ###           ###        ##.#        ####.##"
1020 LPRINTUSING H$;Q3,W1,Q,(Q/W1)*100,Q1
1030 LPRINTUSING H$;Q6,W2,Q4,(Q4/W2)*100,Q5
1040 LPRINTUSING H$;Q9,W3,Q7,(Q7/W3)*100,Q8
1050 LPRINT"-------------------------------------------------------------"
1060 H1$="                    TOTAL  ###             TOTAL ####.##"
1070 LPRINTUSING H1$;G,G1
1080 LPRINT"  "
1090 RESTORE::CLEAR1000:INPUT"DO YOU WANT ANOTHER SORT ...  Y=YES ...  N=NO";S$
1100 IF S$="Y" GOTO 150     ELSE PRINT"PROGRAM COMPLETED":END
3000 REM   DATA WAS REDUCED FOR DEMONSTRATION.
3010 REM   INSERT YOUR OWN DATA
3020 REM   DATE, TRUCK #, ITEM, DAMAGE, REPAIR COST, DEST.
3030 DATA 0321,2,S,A,30,T
3040 DATA 0314,1,C,L,20,T
3050 DATA 0310,3,T,L,30,T
3060 DATA 0320,2,C,L,25,T
3070 DATA 0320,1,S,M,75,F
3080 DATA 0328,1,T,G,140,F
3090 DATA 0320,1,S,A,80,T
3100 DATA 0315,3,D,D,38,T
3110 DATA 0311,1,S,A,85,F
3120 DATA 0322,1,S,A,75,T
3130 DATA 0316,1,L,C,15,F
3140 DATA 0318,1,T,T,525,T
3150 DATA 0318,3,W,S,100,T
3160 DATA 0319,1,W,D,65,T
3170 DATA 9999,9999,9999,9999,9999,9999
```

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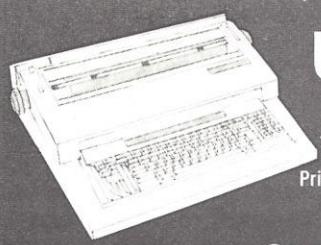

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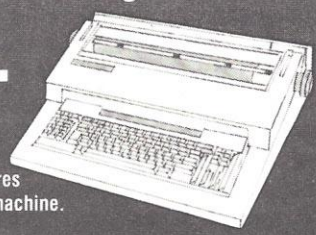

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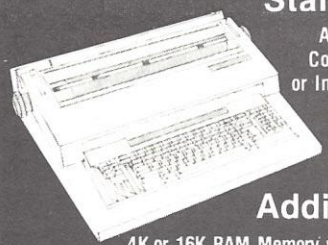

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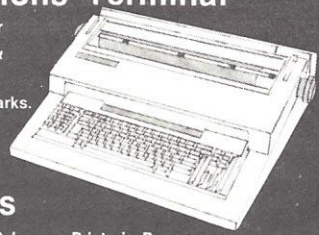

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CIRCLE 26

Understanding BASIC Language Operations

An introduction to how your computer looks at BASIC, plus two handy utility programs for the Apple.

BY TOM SWAN

To become a good doctor, you must first become a good detective. Before the cure must come the diagnosis, and before that, the study of anatomy.

So it is for programmers who wish to learn more about the world of binary computers. This article provides an introductory course in Basic program anatomy. I'll show how program lines really "look" to a computer and why they are structured the way they are. You'll gain the knowledge to perform your own Basic surgery on a binary level. You will be able to fix damaged program lines and even insert "illegal" statements into a program. Two useful machine language utility programs will be presented that may often be used to save 25% or more memory space in your Basic programs.

My computer system is a growing disk-based Apple II with 48K of RAM and the UCSD Pascal Language Card. The following descriptions result from much serious detective work performed on that system. The internal structures of both Applesoft and Integer Basic programs will be covered, but the comments are general enough to apply to most other home computers using similar Basic interpreters. The two utility programs will run on any size Apple II or II Plus system with interpreters in either RAM or ROM. You do not need a disk drive or the language card to run and use the programs.

First let's examine a Basic program from a computer's point of view. That viewpoint is so exacting that the data presented to it must be structured to meet the computer's critical eye. Experienced programmers appreciate the need to define the structure of a program's data before the operations on that data may be written. Therefore, let's begin at the beginning — with the structure of a Basic program represented as data inside a computer's memory.

On most computers in operation today, Basic programs are run using an interpreter. An interpreter is no more than another program with a singular, though complex, job to perform. This job may be broken into two general operations:

1) Determine what action is to be performed next.

2) Cause that action to be performed.

These two processes are repeated over and over by the interpreter, usually in the machine's native language. We could add a third operation to indicate the cycling that occurs within the interpreter:

3) GOTO #1.

In other words, the interpreter first "gets" an instruction from somewhere, then does the action intended by that instruction. Then the interpreter "gets" the next instruction, does that one, "gets" another, and so on. It is important to understand that this process operates on *data* in the form of Basic programming statements. The statements themselves do nothing at all. It is the interpreter's responsibility to determine the proper actions to be executed as requested by those statements.

When an incomprehensible (to the interpreter) instruction is encountered, a syntax or other error message will be generated. This feature prevents a program from returning hidden flawed values due to programming errors. Often, an interpreter's loader will be smart enough to catch many of these errors *while* they are being typed. For example, it's very difficult to type improper instructions into an Apple Integer Basic program. Applesoft programs, however, may contain many syntactical errors that will only be detected when the program is RUN.

All of this implies that the instructions typed into a computer are stored somewhere as structured data — in places where they may be easily found by the interpreter. Critical in any interpreter is where and even more important, *how* instructions are coded into memory. Most Basic interpreters use "simple linked lists" containing variable sized elements. If that sounds like too much for you to bite off and chew, don't worry. It's not as difficult to understand as it may seem.

What does a line of a Basic program look like to a computer? You may be surprised to discover what you type into a computer on a keyboard is not at all similar to the resulting form that is stored in the computer's memory. Because the computer can only "understand" numerical quantities, it must be fed binary numbers representing the text that is typed and displayed in a human readable form. Digital computers can be made to recognize the *code* for the letter "A" but not the actual letter "A". Program lines, therefore, are stored in binary form inside the computer's memory. These numbers are converted back into text characters for displaying when a program is LISTed.

But that is only a small part of the process a computer uses to store programs written in Basic. If each character typed in was stored numerically, interpreted programs would occupy enormous amounts of memory space and run ponderously slow. In fact, early interpreters did exactly that!

Computer scientists solved the problem by taking advantage of the natural redundancy inherent in any language — computer, human or otherwise. (Just count, for instance, the number of times the word "the" is used in this article! Three times in *the* last sentence alone!) Because of the numerical nature of a

computer, there is no need to store each letter of the Basic PRINT command in memory. Instead, a numerical code is used to represent the entire word "PRINT". On 8-bit microcomputers, that code fits very nicely into only one byte of memory, the smallest integral unit of memory space in a typical home computer. In the case of "PRINT", this code represents a savings of four bytes over what it would take to store the five characters of the whole word. If there are 100 PRINT statements in a Basic program, the encoding of the word PRINT saves exactly 400 memory bytes of space. That is enough for 400 *more* PRINT commands.

In fact, each of the reserved "keywords" in a Basic program is associated with one and only one 8-bit code. (See Tables 1 and 2 for the Apple's use of these codes.) These codes are commonly called "tokens." While a Basic program line is being typed into the computer, the keywords in each line are turned into these tokens by the interpreter and stored in memory. Listing a program reverses the process. Each token is re-translated into the more recognizable keywords, greatly easing a human's interaction with the machine. (Imagine programming in Basic if you were required to look up each token yourself!)

Along with tokenizing a program's keywords, various memory pointers, codes and devices may be generated as a means of locating the program's data. For example, some indication, perhaps a memory address pointer, is needed to refer to strings and variables used during execution of the program. A discussion of these topics becomes quite complex and carries us away from the purpose of this introduction to Basic internal anatomy. But you should be aware that the entire process is quite involved and requires careful programming to implement.

Figure 1 shows the construction of an Applesoft program line as it appears in the computer's memory. Figure 2 is a similar diagram of an Apple Integer Basic program line. The two are similar in some ways but drastically different in others.

The Applesoft construction begins with a two-byte value. This value is the 16-bit address where the *next* program line may be found in memory. It is not equivalent or even related to the Basic line numbers that precede each program line. The two-byte address is called a "link" and points to the physical position in the computer's memory where a new program line may be found. This is *always* the next actual program line in sequence.

Figure 1

APPLESOFT PROGRAM LINE STRUCTURE

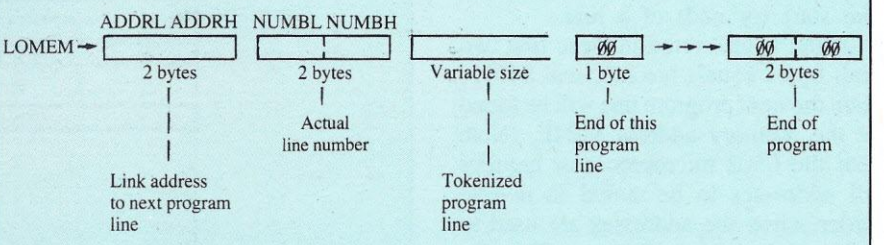


Figure 2

INTEGER BASIC PROGRAM LINE STRUCTURE

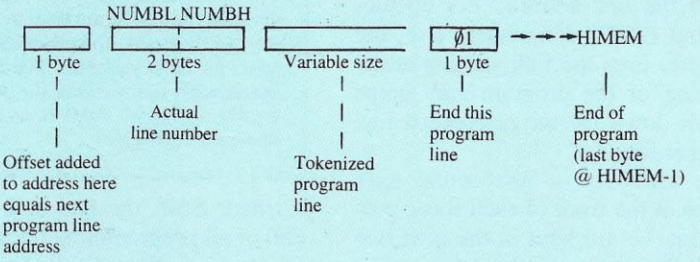
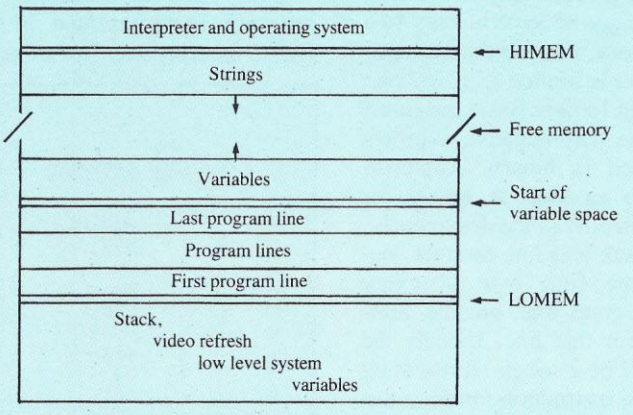


Figure 3

APPLESOFT MEMORY MAP



Program lines begin at the lowest available memory location and build toward higher memory addresses. Space for variables and arrays begins at an address just higher than the highest address occupied by the tokenized program.

Applesoft strings start at the highest available memory location and build toward lower memory addresses. This allows for dynamic strings to be easily declared in the program without having to specifically DIMension a string variable.

Notice how memory space is allocated to be certain that overflow only occurs after all available space has been used. Both strings and variables have the opportunity to use as much space as needed until the two areas bump into each other. The disadvantage of this arrangement is the necessity to periodically clear old strings from memory to free up space, a time consuming operation called "garbage collection."

The map is the same for programs using the RAM version of Applesoft. However, because the interpreter itself is located from LOMEM to address 12291, program lines begin above that location.

At first, such an arrangement may seem redundant and useless. It is not of course. These links allow program lines to be of any practical size but take up only as much room as needed. Without linking, it might be necessary to store coded program lines in fixed chunks of memory, resulting in much empty, wasted space for those lines that did not fill the allotted room. Other possibilities result in time consuming

searches to find the start of program lines. Some text editors, for example, simply look for occurrences of a carriage return code (ASCII $OD) to find the start (or end) of a line.

If the value stored in these first two link bytes equals hexadecimal $4F12, then the next program line will be found at the memory address $124F. (Note that the 6502 microprocessor requires all addresses to be stored in reverse order when the addresses are used as data, as they are in this case. Thus the high byte, $12, is stored *after* the low byte, $4F.) When the interpreter is finished executing the current program line (provided it is not directed to a new sequence by a GOSUB or GOTO type of instruction), it finds the next line through the link address. For instructions that *GOTO* somewhere else, the interpreter uses the link starting at the beginning of the program and jumps right on down till the referenced line number is found.

Line numbers — the actual ones typed in at the front of each Basic program line — are kept in the next two bytes following the link address. (See Figure 1.) Again this represents a considerable memory savings over storing the numbers as individual characters as they are typed in. Line numbers from 0 up to 65535 may be kept in only two bytes of memory. Frequently the highest line number is limited to 32767 (for example, in an Integer Basic program) because of the way negative numbers are represented in binary. Applesoft lines may go as high as 63999 for reasons known only to the designers.

After the link and line number, beginning at the fifth byte of every tokenized program line, are the command codes for that line. Usually the fifth byte will be a token representing some program instruction for the interpreter to perform. Or a variable name may begin at this position, coded in ASCII character code and thus distinguishable from the tokenized keywords. But whatever is found there, the action begins at the fifth byte, the preceding four bytes (the link and line number) offering the means for finding the location of a program's statements. This is why the term "structured data" was used earlier to describe the storage of Basic program lines.

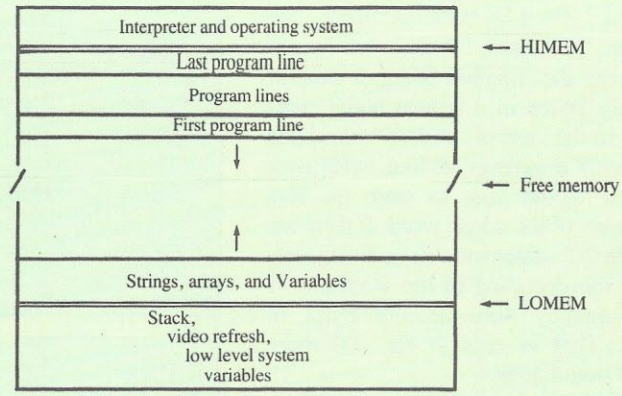
The very last item of an Applesoft program line is always a $00 byte. This zero byte tells the interpreter to end its executing phase and prepare to get the next instruction line to be performed.

Sometimes the execution of a line will be terminated by the actions performed. Still, the $00 byte marks the end of all programming lines regardless of what is in these lines. This byte may be referred to as a "separator", a machine language equivalent to Pascal's semicolon.

Every line in a Basic's Applesoft program is represented in this way. Other interpretive Basics use similar approaches. The actual tokenized line may take on a variety of forms, but it always begins at the same relative place preceded by the fixed size linking information. Armed with this knowledge, you could use the Apple's monitor to construct program lines in binary or hexadecimal, enter illegal symbols into PRINT statements with the

INTERGER BASIC MEMORY MAP

Figure 4



Memory space for an Integer BASIC program is also allocated dynamically permitting variables and program lines to take just as much space as needed. Unlike Applesoft program storage, however, Integer BASIC strings must be DIMensioned to reserve a fixed amount of space for those variables. The disadvantage of this technique is the potential for wasted space inaccessible to the rest of the program. But it is unnecessary to perform "garbage collection" on old strings so there is no clear answer to which method is preferable in all cases of interpreter design.

APPLESOFT TOKENS

Table 1

HEX	DECIMAL	KEYWORD	HEX	DECIMAL	KEYWORD	HEX	DECIMAL	KEYWORD
80	128 --	END	A4	164 --	LOMEM:	C8	200 --	+
81	129 --	FOR	A5	165 --	ONERR	C9	201 --	−
82	130 --	NEXT	A6	166 --	RESUME	CA	202 --	*
83	131 --	DATA	A7	167 --	RECALL	CB	203 --	/
84	132 --	INPUT	A8	168 --	STORE	CC	204 --	∧
85	133 --	DEL	A9	169 --	SPEED=	CD	205 --	AND
86	134 --	DIM	AA	170 --	LET	CE	206 --	OR
87	135 --	READ	AB	171 --	GOTO	CF	207 --	>
88	136 --	GR	AC	172 --	RUN	D0	208 --	=
89	137 --	TEXT	AD	173 --	IF	D1	209 --	<
8A	138 --	PR#	AE	174 --	RESTORE	D2	210 --	SGN
8B	139 --	IN#	AF	175 --	&	D3	211 --	INT
8C	140 --	CALL	B0	176 --	GOSUB	D4	212 --	ABS
8D	141 --	PLOT	B1	177 --	RETURN	D5	213 --	USR
8E	142 --	HLIN	B2	178 --	REM	D6	214 --	FRE
8F	143 --	VLIN	B3	179 --	STOP	D7	215 --	SCRN(
90	144 --	HGR2	B4	180 --	ON	D8	216 --	PDL
91	145 --	HGR	B5	181 --	WAIT	D9	217 --	POS
92	146 --	HCOLOR=	B6	182 --	LOAD	DA	218 --	SQR
93	147 --	HPLOT	B7	183 --	SAVE	DB	219 --	RND
94	148 --	DRAW	B8	184 --	DEF	DC	220 --	LOG
95	149 --	XDRAW	B9	185 --	POKE	DE	221 --	EXP
96	150 --	HTAB	BA	186 --	PRINT	DF	222 --	COS
97	151 --	HOME	BB	187 --	CONT	E0	223 --	SIN
98	152 --	ROT=	BC	188 --	LIST	E1	224 --	TAN
99	153 --	SCALE=	BD	189 --	CLEAR	E2	225 --	ATN
9A	154 --	SHLOAD	BE	190 --	GET	E3	226 --	PEEK
9B	155 --	TRACE	BF	191 --	NEW	E4	227 --	LEN
9C	156 --	NOTRACE	C0	192 --	TAB(	E5	228 --	STR$
9D	157 --	NORMAL	C1	193 --	TO	E6	229 --	VAL
9E	158 --	INVERSE	C2	194 --	FN	E7	230 --	ASC
9F	159 --	FLASH	C3	195 --	SPC(	E8	231 --	CHR$
A0	160 --	COLOR=	C4	196 --	THEN	E9	232 --	LEFT$
A1	161 --	POP	C5	197 --	AT	EA	233 --	RIGHT$
A2	162 --	VTAB	C6	198 --	NOT	EB	234 --	MID$
A3	163 --	HIMEM:	C7	199 --	STEP			

help of Tables 1 and 2 or insert secret copyright notices with the links set to skip around them! Sometimes a Basic listing may become damaged by a fault in the program logic. Repairs to Basic lines are possible if you are willing to take the time to study the byte-by-byte form of your program. And once the data structure of a program is known it becomes a relatively easy job to write machine language utility programs that operate on that structure.

Apple's Integer Basic interpreter also stores its program lines in tokenized form (see Figure 2). A similar format is used, with linking and line number information stored in the first three bytes of each line.

Unlike Applesoft, however, only the first byte of an Integer Basic program line is used as a memory address link to the next line in sequence. And in this case the byte is not the actual address of the next line, but rather an offset value which is used to calculate the needed address.

If for example the current position of the tokenized line is at memory location $3600, and if the first byte of that same line is $20, then the *next* program line will be found to begin at the sum of the two numbers (without regard to the sign of the offset). In this example, the next line will be found at memory location $3600 + $20 = $3620. Program lines are thus limited in length to 251 bytes (255 − 3 bytes for the link and line number − 1 stop byte).

The offset may be referred to as a link since that is its purpose. But the process of linking tokenized Integer Basic lines is vastly different from the same process in Applesoft, which uses a real memory address link instead of the offset. (Compare Figures 1 and 2.)

Following the offset byte are two bytes representing the binary value of the current program line (see Figure 2). This value is stored in reverse order (low byte/high byte) in the same manner of 16-bit addresses as explained previously. Line numbers in Applesoft and Integer Basic are stored in the exact same way.

After the line number comes the tokenized program line just as in Applesoft. Though again quite similar in form, Integer Basic tokens are completely incompatible with those used by Applesoft. (See Tables 1 and 2.) Those of you with a disk system can convert one Basic to another by using an intermediate text form of your program stored in a disk file. Without the disk, it is clear that such translation by hand would be difficult if not impossible to accomplish. (But a program could easily be written to do it!)

Now that the construction of a tokenized Basic program is clear, the means for accessing those lines must be discovered. Again, Applesoft programs and Integer Basic programs differ vastly in their use of available memory storage space.

Both interpreters store program lines with the lowest line numbers occupying the lower memory addresses. Thus both Basics cause a program to be executed in the low to high address sequence that is normal for most processors. (See Figures 3 and 4 for these Basics's memory maps.)

When storing programs into memory, Applesoft begins at the lowest available memory address, adding new program lines at higher addresses as needed.

Integer Basic takes a different strategy. Program lines in an Integer program are inserted at the top end of memory beginning with the highest available memory address. New program lines are built from that point down toward lower and lower memory addresses. If it were possible to write in both Basics at the same time, the program lines would appear to grow toward each other, beginning at opposite ends of memory — sort of like burning a candle at both ends. Of course this is not possible; I only mention it for illustration.

While programming, the occasion to insert new statements between others frequently arises. Both Basics use a similar technique to permit this. Once again the differences are subtle but critical.

To insert lines in Applesoft, the interpreter begins at LOMEM (Low Memory Address) and, using the two-byte link, locates the next program line number *higher* (or equal to) the one being inserted. This line and everything beyond it extending toward HIMEM (High Memory Address) are moved up to make room for the new line. The new

INTEGERS BASIC TOKENS **Table 2**

HEX	DECIMAL	KEYWORD	HEX	DECIMAL	KEYWORD	HEX	DECIMAL	KEYWORD
0	0 --	HIMEM:	02C	44 --	!	58	88 --	STEP
1	1 --		2D	45 --	(	59	89 --	NEXT
2	2 --	−	2E	46 --	PEEK	5A	90 --	,
3	3 --	:	2F	47 --	RND	5B	91 --	RETURN
4	4 --	LOAD	30	48 --	SGN	5C	92 --	GOSUB
5	5 --	SAVE	31	49 --	ABS	5D	93 --	REM
6	6 --	CON	32	50 --	PDL	5E	94 --	LET
7	7 --	RUN	33	51 --	RNDX	5F	95 --	GOTO
8	8 --	RUN	34	52 --	(	60	96 --	IF
9	9 --	DEL	35	53 --	+	61	97 --	PRINT
A	10 --	,	36	54 --	−	62	98 --	PRINT
B	11 --	NEW	37	55 --	NOT	63	99 --	PRINT
C	12 --	CLR	38	56 --	(	64	100 --	POKE
D	13 --	AUTO	39	57 --	=	65	101 --	,
E	14 --	,	3A	58 --	#	66	102 --	COLOR=
F	15 --	MAN	3B	59 --	LEN(	67	103 --	PLOT
10	16 --	HIMEM:	3C	60 --	ASC(	68	104 --	,
11	17 --	LOMEM:	3D	61 --	SCRN(	69	105 --	HLIN
12	18 --	+	3E	62 --	,	6A	106 --	,
13	19 --	−	3F	63 --	(	6B	107 --	AT
14	20 --	*	40	64 --	$	6C	108 --	VLIN
15	21 --	/	41	65 --	$	6D	109 --	,
16	22 --	=	42	66 --	(	6E	110 --	AT
17	23 --	#	43	67 --	,	6F	111 --	VTAB
18	24 --	>=	44	68 --	,	70	112 --	=
19	25 --	>	45	69 --	;	71	113 --	=
1A	26 --	<=	46	70 --	;	72	114 --	)
1B	27 --	3fi fl	47	71 --	;	73	115 --	)
1C	28 --	<	48	72 --	,	74	116 --	LIST
1D	29 --	AND	49	73 --	,	75	117 --	,
1E	30 --	OR	4A	74 --	,	76	118 --	LIST
1F	31 --	MOD	4B	75 --	TEXT	77	119 --	POP
20	32 --	^	4C	76 --	GR	78	120 --	NODSP
21	33 --	+	4D	77 --	CALL	79	121 --	NODSP
22	34 --	(	4E	78 --	DIM	7A	122 --	NOTRACE
23	35 --	,	4F	79 --	DIM	7B	123 --	DSP
24	36 --	THEN	50	80 --	TAB	7C	124 --	DSP
25	37 --	THEN	51	81 --	END	7D	125 --	TRACE
26	38 --	,	52	82 --	INPUT	7E	126 --	PR#
27	39 --	,	53	83 --	INPUT	7F	127 --	IN#
28	40 --	"	54	84 --	INPUT	80-BF 128-191 Not used		
29	41 --	"	55	85 --	FOR	CO-FF 192-255 ASCII CHAR		
2A	42 --	(	56	86 --	=	SET WITH MSB=1		
2B	43 --	!	57	87 --	TO			

NOTE: This chart was prepared by letting the computer parse (translate) successive codes from 0 to 255 then printing the results. Notice that there are several duplications. Some study and experimentation will be needed to discover which of the duplicates may be used in an actual program.

line is then inserted. Because real memory addresses are used to link the program lines in memory, all links of all lines moved and/or inserted must be adjusted by a constant factor equal to the length of the inserted line. The old link values are no longer correct after moving the program lines to different locations.

Inserting lines in an Integer Basic program is a much simpler process. Once again a search for the next higher line number is initiated. When found, all program lines *below* that line (toward LOMEM) are moved down to make room for the new one. Then the new line is inserted. Because Integer Basic uses an offset value for the link, that value is independent of the actual memory location for that line. In other words, there is no need to adjust the offsets — they remain correct no matter where the program exists in memory. A new offset equal to the length of the line being inserted is simply attached to the front of that line.

Deleting program lines is the reverse process for both Basics.

While this discussion does not cover every aspect of the Basic program data structure, it does define that structure with enough detail to perform minor surgery. To find the starting and ending locations of program lines, use Table 3.

Table 3

Applesoft Interpreter

$67 - $68	(103 - 104)	— Beginning address of program
$69 - $6A	(105 - 106)	— Start of free memory for variables
$AF - $B0	(175 - 176)	— End of program

Integer BASIC Interpreter

$4C - $4D	(76 - 77)	— End of program + 1 (HIMEM)
$CA - $CB	(202 -203)	— Beginning address of program

From either BASIC, the following immediate mode command line may be used to find memory parameters as explained in the above chart.

```
    >PRINT PEEK(ADDRL) +PEEK(ADDRH) *256
ex.>PRINT PEEK(103) +PEEK(104) *256
```

If you receive a negative answer, subtract its absolute value from 65536. In other words, if the answer is -31708, the positive equivalent is 65536-ABS(-31708) or 33828.

This PEEK technique generates a decimal address which is sometimes out of the allowable Integer BASIC range. If you receive an error message, use the system monitor to obtain the address in hexadecimal. Remember that the high part of the address is stored after the low part. Another way is to find PEEK(ADDRL) and PEEK(ADDRH) separately then use Applesoft which permits higher values to be calculated to determine ADDRL+ADDRH*256.

Try examining memory containing a few simple program lines. See if you can make out the structure of the line and perhaps insert new token values using the system monitor to change PRINT to GOSUB, and so forth. Insert new lines and watch how the link information is changed. Be a Basic detective — some day you'll find applications for the discoveries you make today.

Now let's look at two utility programs based on the Basic anatomy we've covered.

The REMalators

What is a REMalator? The answer is simple: A REMalator is a program that REMalates! Such a recursive definition will not do, though, and the description must be extended.

My REMalators are two proven lifesavers for programming in Basic. Presented here are an Applesoft REMalator and an Integer Basic REMalator. Each performs one simple but useful function: removing (REMalating) all REMarks from a Basic program listing. Both programs are listed here along with general algorithms which will help non-Apple owners write their own versions. Either REMalator may be used in an Apple containing any amount of memory using interpreters in ROM or RAM. Versatility is a virtue too often skipped by programmers, and it was built into these programs for your convenience.

If you have an asssembler you may wish to re-assemble the listing yourself. However the programs are not long, and it should be just as simple for you to enter the hexadecimal codes using the Apple's system monitor. (If you are using the Autostart ROM, CALL -151 gets you into the monitor. Otherwise just use <RESET>.).

Each REMalator is assembled here at hexadecimal address $310. This allows the REMalator to be kept in memory as a development tool undisturbed by entering or running most Basic programs. The Applesoft version occupies 162 bytes from hexadecimal $310 to $3B1. The Integer Basic version is shorter; only 104 bytes were needed at locations $310 to $377. This addressing information should help you to prepare disk or tape files containing the programs for repeated use. The decimal equivalent to $310 is 784.

To use either REMalator, load the Basic program to be REMalated, then type CALL 784 with the proper REMalator in memory. (The REMalator may be loaded before or after loading the program.) If you are in the monitor mode ("*" prompt symbol), typing 310G will have the same effect *except* possibly just after system startup. No errors occur by running the REMalator (using CALL 784) without a Basic program in memory, but please be careful to use the right REMalator! Obviously, the Applesoft REMalator cannot be used on Integer Basic programs and vice versa. Using the wrong REMalator could have disasterous results to your program and the computer may have to be reset manually to recover. Also when REMalating is in progress, do not attempt to reset the computer. Large programs (greater than 8K) may take up to a minute or more to fully REMalate. A patient wait for the cursor to return before pressing any keys on the keyboard will avoid damaging your program. Short programs will REMalate just about instantaneously.

Before rushing off to REMalate all documentation from your program li-

brary, let's take a moment to examine some features of the REMalators and explain why and when they should be used, and why and when they should not.

The single most important reason for removing REMarks from a program is to create more programming space. Program without REMarks will also run a little faster. The best argument against REMalating is that a REMarkless Basic listing is about as easy to read as Chinese on microfilm without a magnifier! Before taking REMarks out of a listing, you would be wise to save a copy of the original program (including all REMarks) where it won't be accidentally erased. I always keep extensive documentation on paper, too.

Unlike commercial Basic program compactors (which sell for far more than a subscription to this magazine) the REMalators presented here are rather simple minded. Two cautions are necessary for a successful REMalation. First, only those REMarks which appear as the first program statement on a line will be removed. Second, no checks are made to see if the line being removed is referenced somewhere else by a GOTO or GOSUB type of instruction., These restrictions are not as limiting as they may seem, and as an afterthought I have found them to impose desirable constructs on my Basic programming.

Because checks for referenced lines are not made, the following two Applesoft examples in Table 4 demonstrate the right and wrong way to present a program for REMalation:

The "Right" program will operate identically after all its REMarks are removed. None of the REMark program lines are referenced from anywhere else in the program. By the way, even this simple example gains 136 bytes by REMalating. The savings for a large 8K program with good documentation are typically near 2K bytes or more for an average savings of 25%.

The "Wrong" program includes a GOSUB 50 in line 10. Line 50 is a REMark line, however, so after that program is REMalated, RUNning will produce the following error:

```
? UNDEF'D STATEMENT ERROR IN 10
```

To fix such an error, you could first LIST line 10, note the GOSUB 50, then find the smallest existing line number greater than 50 — line 100 in this example. Changing 10 to GOSUB 100 then fixes the error. Adjusting a large program this way is possible though it will take some time. It is preferable for you to write your programs keeping the limitation in mind.

A side benefit of this limitation will be a slight increase in the running speed of your program even with the REMarks left in. There is *never* a good reason to directly reference a program line containing only a REMark. Your programs will run more efficiently if you reference only real programming statements, and following REMalation, will run exactly as before without modification.

If you have tried the sample program (the "Right" one) with and without REMalation, you may have noticed that the REMark in line 40 was *not* removed. Only if a REMark is the *first* item on the line will it be removed. This restriction made writing the REMalators a little simpler though it would have been possible to remove all REMarks, even those at the ends of programming lines, without much effort. However, I left this in as a feature permitting REMarks to be protected from REMalation. Applesoft allows a colon (:) to preface a program line. REMarks prefaced this way will not be removed. For example:

```
110 REM THIS REMARK WILL BE ZAPPED!
110 :REM THIS REMARK IS PROTECTED.
```

Gaining extra program space at the expense of losing subroutine titles may not be desirable, and this feature will help save needed comments. The colon saves the REMark. Unfortunately Integer Basic does *not* permit a leading colon. Something like the following will do the same job:

```
100 REM THIS COMMENT GOES!
110 X=X : REM THIS ONE STAYS.
```

The REMalator programs are well documented and you should have no trouble following the code if you are familiar with 6502 assembly language. Of course you do not need to understand the machine code to use the programs.

Ideally these routines could be reassembled as part of a fancier compactor that would remove *all* REMarks as well as *all* unreferenced line numbers. Unreferenced program lines would be combined into multiple statement line, with the entire listing scrunched as much as possible. Even greater space savings are then possible — though before beginning such a project, be aware that is not an easy program to write. In any case, the largest savings will come from simply removing REMarks.

Those of you who are considering a commercial compactor program should investigate the price of extra memory first. I recently purchased 16K for my Apple for about $70. Why squeeze a program into a small space when it's just as cheap — maybe cheaper — to buy more space?

To fully cover the entire structure and mechanics of a Basic interpreter could fill several magazines this size. Rather than even attempt to do a complete job, this article was limited to a description of the way program lines are represented in memory. Those of you with enough curiosity will be able to see how the REMalators function by simply maintaining the proper data structure of a Basic program as changes are made to that data. Those of you who aren't interested in wading through the often complex pool of binary numbers and machine language will at least have two useful utility programs to add to your libraries.

The internal workings of computers do not need to be dark and mysterious. □

Table 4

Right

```
 10 GOSUB 100
 20 IF X=0 THEN END
 30 PRINT "SIN(X)="; SIN(X)
 40 GOTO 10 :REM REPEAT
    UNTIL X=0
 50 REM
 60 REM **GET X SUB**
 70 REM
 80 REM PROMPT USER FOR
    VALUE
 90 REM
100 PRINT: INPUT "—>";X
110 RETURN
120 REM
130 REM THIS PROGRAM WILL
    RUN
140 REM FOLLOWING
    REMALATION
```

Wrong

```
 10 GOSUB 50
 20 IF X=0 THEN END
 30 PRINT "COS(X)=";COS(X)
 40 GOTO 10 :REM REPEAT
    UNTIL X=0
 50 REM
 60 REM **GET X SUB**
 70 REM
 80 REM PROMPT USER FOR
    VALUE
 90 REM
100 PRINT: INPUT "—>";X
110 RETURN
120 REM
130 REM THIS PROGRAM WILL
    NOT RUN
140 REM FOLLOWING
    REMALATION
```

APPLESOFT REMALATOR ALGORITHM

1) START : SET A2 ← ENDPRG : LINK ← STRPRG

2) Y ← 1 : IF (LINK),Y = 0 THEN AT END OF PROG : GOTO 9
   Y ← 4 : IF (LINK),Y = $B2 THEN GOTO 4 (REM token found)

3) REMark not found and not at end of program
   SET LINK ← LINK(LINK) AND GOTO 2

4) REMark found : OLDLINK ← LINK (SAVE POSITION)*
   SET A4 ← LINK : A1 ← LINK(LINK)
   DISP ← − A4 (displacement)

5) Move program lines up (direction is towards LOMEM)
   MOVE A4 ← A1 THRU A2 : A2 ← A2 − DISP (NEW END)

6) Adjust all forward links which are now wrong.
   Y ← 1 : IF (LINK),Y = 0 THEN SET LINK ← OLDLINK AND GOTO 2
   (that is, do the next step from here to the end of the program.)

7) ELSE SET LINK(LINK) ← LINK(LINK) − DISP
   LINK ←LINK(LINK) — (See #3)
   GOTO 6

8) End of program found. Now reset Applesoft pointers.
   SET STRVAR (etc) ← A2 (New end of program pointer)
   END.

*= NOTE: LNKADJ sub handles sving and restoring LINK. Less memory was used by letting A4 = OLDLINK, but that variable name is used in the algorithm for clarity.

```
;**********************
; APPLESOFT REMALATOR
;**********************
;
*       =  $310
LINK    =  $FA
DISP    =  $FC
STRPRG  =  $67
STRVAR  =  $69
STRARR  =  $6B
ENDNUM  =  $6D
ENDPRG  =  $AF
```

```
REMLT3:  JSR   LNKADJ      ; Adjust forward links
         BNE   REMLT2      ; Go loop (main) Z flag is
                           ;   always = Ø here
;
; DONE REMALATING.  RESET APPLESOFT POINTERS
;
REMLT4:  LDA   A2L         ; A2 = new end of program
         STA   STRVAR      ;   pointer which is actually
         STA   STRARR      ;   three bytes past the
         STA   ENDNUM      ;   last (LINK).  These
         STA   ENDPRG      ;   pointers show Applesoft
         LDA   A2H         ;   where to start simple
         STA   STRVAR+1    ;   variables, arrays and
         STA   STRARR+1    ;   where the end of numerical
         STA   ENDNUM+1    ;   storage and the program are.
         STA   ENDPRG+1    ;   See page 140-141 Applesoft Manual
         RTS               ; Return from REMLTR sub

;************************************************************
; LNKADJ   ADJUST FORWARD LINKS
;************************************************************
; INPUT:       LINK addresses first moved up program line
;              DISP = # bytes displaced
;
; OUTPUT:      All LINKS ← LINKS - DISP
;
; CALLS:       DISPER   LINKER
;
; CALLED BY:   Main Loop
;
; CHANGES:     A4, rA, rY (= 1 on return) (Z flag = 0 on return)
;************************************************************

LNKADJ:  LDA   LINK        ; OLDLNK ← LINK, that is,
         STA   A4L         ;   save LINK value, the
         LDA   LINK+1      ;   current position in the
         STA   A4H         ;   program, in variable A4
         BNE   LNKAD2      ; Jump to start (rA ≠ Ø here)
LNKAD1:  JSR   DISPER      ; LINK(LINK) ← LINK(LINK) - DISP
         JSR   LINKER      ; LINK ← LINK(LINK)
LNKAD2:  LDY   #1
         LDA   (LINK),Y    ; Test for end program marker
         BNE   LNKAD1      ; Loop if not at end of program
         LDA   A4L         ; Restore LINK from
         STA   LINK        ;   values saved in A4
         LDA   A4H
         STA   LINK+1
         RTS               ; Return from subroutine
```

```
A1L     =  $3C
A1H     =  $3D
A2L     =  $3E
A2H     =  $3F
A4L     =  $42
A4H     =  $43
MOVE    =  $FE2C
;
REMLTR:   LDA    ENDPRG        ; Transfer End of Program
          STA    A2L           ;   address to A2 with low
          LDA    ENDPRG+1      ;   byte first, high byte second
          STA    A2H
          LDA    STRPRG        ; Do the same for the start
          STA    LINK          ;   of the program to set
          LDA    STRPRG+1      ;   up the variable LINK as
          STA    LINK+1        ;   pointer to program lines
          BNE    REMLT2        ; Jump to start main loop
;
; MAIN LOOP
;
REMLTR1:  JSR    LINKER        ; Advance to next program line
REMLTR2:  LDY    #$1           ; Y = 1 for indexing link field
          LDA    (LINK),Y      ; Test high byte of link field
          BEQ    REMLT4        ; On Ø, jump to end
          LDY    #$4           ; Check for REM token ($B2)
          LDA    (LINK),Y      ;   at first byte program field
          CMP    #$B2
          BNE    REMLT1        ; Loop on not REM token
;
; REM-ARK FOUND.  SET UP MOVE POINTERS
;
          LDA    LINK          ; A4 ← LINK.  This is the
          STA    A4L           ;   destination address for
          LDA    LINK+1        ;   the monitor MOVE sub
          STA    A4H
          LDY    #$1
          LDA    (LINK),Y      ; A1 ← LINK(LINK). This is
          STA    A1H           ;   the start address of
          DEY                  ;   the memory to be moved.
          LDA    (LINK),Y      ; Y = Ø for upcoming call to
          STA    A1L           ;   MOVE sub


;
; SUBTRACT A1 - A4 FOR DISPLACEMENT
;
          SEC                  ; Preset carry flag = 1
          SBC    A4L           ; Subtract A1 - A4 (rA = A1L here)
          STA    DISP          ; DISP = Absolute value
                               ;   Borrows are ignored
          JSR    MOVE          ; Move A1 thru A2 to A4
;
; ADJUST END OF PROGRAM POINTER
;
          SEC                  ; Preset carry flag = 1
          LDA    A2L           ; Subtract DISP from A2
          SBC    DISP          ;   to form new end of
          STA    A2L           ;   program address in A2
          BCS    REMLT3
          DEC    A2H
```

```
;*****************************************************************
; LINKER   MOVE LINK TO NEXT PROGRAM LINE
;*****************************************************************
; INPUT:       The variable LINK addresses the link field of
;              some program line
;
; OUTPUT:      LINK ← LINK(LINK)
;
; CALLED BY:   LNKADJ
;
; CHANGES:     LINK, rA, rX, rY (rY = 1 on return)
;*****************************************************************
LINKER:   LDY    #Ø            ; Y = Ø for indirect indexed mode
          LDA    (LINK),Y      ; Get low byte LINK(LINK)
          TAX                  ; Keep in rX
          INY                  ; Increment index register
          LDA    (LINK),Y      ; Get high byte LINK(LINK)
          STA    LINK+1        ; Put high byte into LINK
          STX    LINK          ; Put low byte into LINK
          RTS                  ; Return from subroutine

;*****************************************************************
; DISPER   SUBTRACT DISPLACEMENT
;*****************************************************************
; INPUT:       LINK addresses link field needing adjustment
;
; OUTPUT:      LINK(LINK ← LINK(LINK) - DISP (double precision)
;
; CALLED BY:   LNKADJ
;
; CHANGES:     rA, rY, (LINK)
;*****************************************************************

DISPER:   LDY    #Ø            ; Y = index
          LDA    (LINK),Y      ; Get low (LINK) byte
          SEC                  ; Set the carry flag
          SBC    DISP          ; Subtract displacement
          STA    (LINK),Y      ; Put new low (LINK) byte back
          BCS    DISPE1        ; If no borrow, go exit
          INY                  ; Else Y = 1 = index
          LDA    (LINK),Y      ; Get high (LINK) byte
          SBC    #Ø            ; Subtract the borrow
          STA    (LINK),Y      ; Put high (LINK) byte back
DISPE1:   RTS                  ; Return from subroutine

;*****************************************************************
; MOVE     (MONITOR SUBROUTINE @ FE2C)
;*****************************************************************
; INPUT:       rY = Ø   This is important!
;              A1 = Start address / A2 = End address / A4 =
;              Destination address
;
; OUTPUT:      (A1 thru A2) moved to A4
;
; CALLS:       NXTA4  (also in monitor @FCB4)
;
; CHANGES:     A1, A4, rA
;*****************************************************************

;
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```

APPLESOFT REMALATOR HEX DUMP

```
0310 - A5 AF 85 3E A5 B0 85 3F
0318 - A5 67 85 FA A5 68 85 FB
0320 - D0 03 20 92 03 A0 01 B1
0328 - FA F0 33 A0 04 B1 FA C9
0330 - B2 D0 EF A5 FA 85 42 A5
0338 - FB 85 43 A0 01 B1 FA 85
0340 - 3D 88 B1 FA 85 3C 38 E5
0348 - 42 85 FC 20 2C FE 38 A5
0350 - 3E E5 FC 85 3E B0 02 C6
0358 - 3F 20 73 03 D0 C7 A5 3E
0360 - 85 69 85 6B 85 6D 85 AF
0368 - A5 3F 85 6A 85 6C 85 6E
0370 - 85 B0 60 A5 FA 85 42 A5
0378 - FB 85 43 D0 06 20 9F 03
0380 - 20 92 03 A0 01 B1 FA D0
0388 - F4 A5 42 85 FA A5 43 85
0390 - FB 60 A0 00 B1 FA AA C8
0398 - B1 FA 85 FB 86 FA 60 A0
03A0 - 00 B1 FA 38 E5 FC 91 FA
03A8 - B0 07 C8 B1 FA E9 00 91
03B0 - FA 60 00 00 00 00 00 00
```

To prepare a cassette tape containing this program, use the following command from the monitor prompt:

*310.377W<RET>

To load the program from tape, use the following:

*310.377R <RET>

To prepare and load a disk file with the Integer BASIC REMalator, use the following DOS 3.2 commands:

>BSAVE INTEGER REMALATOR,A$310,L104

>BLOAD INTEGER REMALATOR

APPLESOFT REMALATOR SYMBOL TABLE

A1H	003D	DISPER	039F	MOVE	FE2C
A1L	003C	ENDNUM	006D	REMLT1	0322
A2H	003F	ENDPRG	00AF	REMLT2	0325
A2L	003E	LINK	00FA	REMLT3	0359
A4H	0043	LINKER	0392	REMLT4	035E
A4L	0042	LNKAD1	037D	REMLTR	0310
DISP	00FC	LNKAD2	0383	STRARR	006B
DISPE1	03B1	LNKADJ	0373	STRPRG	0067
				STRVAR	0069

5) REMark found. Set up MOVE pointer

A1 ← LINK (first byte to move +1)

6) MOVE program lines down (direction is toward HIMEM)

Set STRPRG ← STRPRG + OFFSET (New start of program)

GOTO2

7) DONE REMalating. Integer Basic pointers correct.

```
;
; REM-ARK FOUND.  MOVE LINES DOWN
;
        LDA     LINK        ; Transfer LINK address to
        STA     A1L         ;   A1 to prepare for MOVE
        LDA     LINK+1      ; This address is one greater
        STA     A1H         ;   than first byte to be moved
        JSR     MOVE2       ; MOVE A1 thru STRPRG plus OFFSET
;
; FORM NEW START PROGRAM ADDRESS
;
        CLC                 ; Clear carry to prepare for add
        LDA     STRPRG      ; Add OFFSET to STRPRG for
        ADC     OFFSET      ;   new start of program
        STA     STRPRG      ;   address using double
        BCC     REMLT1      ;   precision arithmetic
        INC     STRPRG+1
        BCS     REMLT1      ; Loop always
;
; END OF MAIN LOOP
;
REMLT4:  RTS                ; End REMLTR

;*****************************************************
; MOVE     MOVE MEMORY DOWN (TOWARD HIMEM)
;*****************************************************
; INPUT:        A1 = First byte to move +1
;               STRPRG = Last byte to move (STRPRG <= A1)
;               OFFSET = Amount <= 255 to move
;
; OUTPUT:       A1 thru STRPRG
;
; CALLED BY:    Main Loop
;
; CHANGES:      A1, rY  (Y = Ø on return)
;*****************************************************
MOVE:   SEC                 ; Preset carry flag for subtract
        LDA     A1L         ; Decrement A1 using double
        SBC     #$Ø1        ;   precision.  A1 addresses
        STA     A1L         ;   bytes to be moved and will be
        BCS     MOVE1       ;   decremented toward LOMEM
        DEC     A1H         ;   until equal to STRPRG
MOVE1:  LDY     #$Ø         ; Set Y = Ø for use as index
        LDA     (A1L),Y     ; Get the byte to be moved
        LDY     OFFSET      ; Set Y = OFFSET (i.e. destination)
        STA     (A1L),Y     ; Store byte ahead @ A1 + OFFSET
```

```
;-------------------------
; INTEGER BASIC REMALATOR
;*************************
;
*       =  $310
A1L     =  $3C
A1H     =  $3D
HIMEM   =  $4C
STRPRG  =  $CA
LINK    =  $FA
OFFSET  =  $FC
;
; INITIALIZE POINTERS
;
REMLTR:   LDA    STRPRG        ; Set LINK = STRPRG to
          STA    LINK          ;  find the first program
          LDA    STRPRG+1      ;   line
          STA    LINK+1
          BNE    REMLT2        ; Jump to start main loop
;
; MAIN LOOP
;
REMLT1:   CLC                  ; Clear carry for upcoming add
          LDA    LINK          ; Add LINK + OFFSET to link
          ADC    OFFSET        ;   to next program line
          STA    LINK
          BCC    REMLT2        ; If C = Ø then skip next
          INC    LINK+1        ; Increment high LINK byte
;
; COMPARE LINK WITH HIMEM
;
REMLT2:   LDA    LINK          ; Compare LINK with
          CMP    HIMEM         ;   HIMEM (i.e. End of program)
          BNE    REMLT3        ; If not equal, continue
          LDA    LINK+1        ; Test high bytes here
          CMP    HIMEM+1
          BEQ    REMLT4        ; If equal, go to exit
;
; NEW OFFSET, TEST FOR REM TOKEN
;
REMLT3:   LDY    #$Ø           ; Set Y = Ø as indirect index
          LDA    (LINK),Y      ; Get LINK field of program line
          STA    OFFSET        ; Store as new OFFSET value
          LDY    #$3           ; Set Y = 3 addressing program field
          LDA    (LINK),Y      ; Test first byte of field
          CMP    #$5D          ; Compare with REM token $5D
          BNE    REMLT1        ; If not equal, loop
```

INTEGER REMALTOR ALGORITHM

1) LINK ← STRPRG : GOTO 3 to start

2)LINK ← LINK + OFFSET (advance to next program line)

3) IF LINK = HIMEM THEN GOTO 7 (End of program found)

4) SET Y ← 0 : OFFSET ← (LINK), Y

Y ←3 : IF (LINK), Y = $5D GOTO 2 (Not a REM token)

```
MOVE2:    LDA    A1L           ; Compare A1 with STRPRG
          CMP    STRPRG        ;   using double precision
          BNE    MOVE          ;
          LDA    A1H           ; When A1 = STRPRG, then all
          CMP    STRPRG+1      ;   bytes have been moved
          BNE    MOVE          ; Else loop until done
          RTS                  ; Return from subroutine
;
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;
; PERMISSION GRANTED FOR PERSONAL USE ONLY

          .END
```

INTEGER BASIC HEX DUMP

```
0310 - A5 CA 85 FA A5 CB 85 FB
0318 - D0 0B 18 A5 FA 65 FC 85
0320 - FA 90 02 E6 FB A5 FA C5
0328 - 4C D0 06 A5 FB C5 4D F0
0330 - 26 A0 00 B1 FA 85 FC A0
0338 - 03 B1 FA C9 5D D0 DB A5
0340 - FA 85 3C A5 FB 85 3D 20
0348 - 6B 03 18 A5 CA 65 FC 85
0350 - CA 90 C7 E6 CB B0 C3 60
0358 - 38 A5 3C E9 01 85 3C B0
0360 - 02 C6 3D A0 00 B1 3C A4
0368 - FC 91 3C A5 3C C5 CA D0
0370 - E7 A5 3D C5 CB D0 E1 60
0378 - 00 00 00 00 00 00 00 00
```

To prepare a cassette tape containing this program, use the following command from the monitor prompt:

*310.3B1W <RET>

To load the program from tape, use the following:

*310.3B1R <RET>

To prepare and load a disk file with the Applesoft REMalator, use the following DOS 3.2 commands:

]BSAVE APPLESOFT REMALATOR,A$310,L162
]BLOAD APPLESOFT REMALATOR

INTEGER BASIC REMALATOR SYMBOL TABLE

A1H	003D	OFFSET	00FC
A1L	003C	REMLT1	031A
HIMEM	004C	REMLT2	0325
LINK	00FA	REMLT3	0331
MOVE	0358	REMLT4	0357
MOVE1	0363	REMLTR	0310
MOVE2	036B	STRPRG	00CA

How to write for Personal Computing

You've written the programs we want to publish. You – the *Personal Computing* readers – are using your computers in businesses, homes, offices and schools. Other readers, just as software-hungry as you, are eager to try out your programs, your applications and your techniques. So why not share what you've done by submitting an article to *PC*?

It's easier than you might think. Remember: we're more interested in practical programs and useful applications than in fancy prose. And our editorial staff stands ready to help with any problems you encounter in writing your article? Just give us a call at (201) 843-0550.

Here are some handy guidelines to help you get started.

First, decide what kind of article you want to write. Do you have a *business program* that will help an executive, salesman, doctor, lawyer or shopkeeper function more efficiently? Think about how businesses can benefit from microcomputers – not only in the obvious areas of inventory, accounting and payroll, but in all departments and levels right up to the president's desk. Financial and marketing analysis, time management, planning, material handling, product design and cost accounting are areas ripe for creative programming.

How do you use your computer for *home and personal applications* in your living room, kitchen, study or den? Again, think beyond the obvious areas of checkbook balancing and budgeting (though these areas are far from exhausted) to other applications. Hobbies, home management, household inventory, gardening and landscaping, personal income and expense analysis, personal mailing lists and word processing are just a few ideas to spark your imagination.

What *education programs* have you written for children, adults, professionals, businessmen and teachers? Computers can not only teach children basic subjects such as spelling, math, geography, economics, civics, grammar, literature and science, but can help adults review or sharpen skills in these areas as well. How else can computers function in or out of the classroom to aid learning? To help teachers and administrators?

Are you proficient in some programming technique or special computer area you could explain in a *tutorial article*? How do you save time, money, computer memory or frustration when programming or using your computer? Others can benefit from the same techniques you use.

Computer games, history, humor and *fiction* are other areas rich in article and story ideas.

Your second step is to write the text of the article. Remember, readers aren't familiar with your program. So explain in detail what the program does and how it does it. Include here the overall structure of your program as well as any special algorithms or routines you've used. Give suggestions for modifying or expanding the program for other applications, other businesses or other situations.

Third, prepare your supporting documentation. Include at least a program listing and one or two sample runs, and add program notes to explain any special commands used or other special features of your program. Use charts, diagrams, figures and photos if they help explain your program and its use.

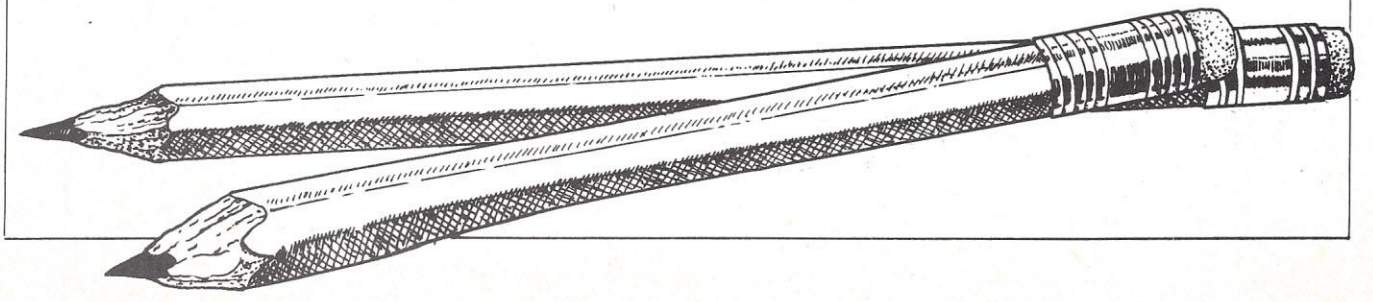
Finally, mail your manuscript. Address it to: Jules Gilder, Editor, Personal Computing Magazine, Hayden Publishing Co., 50 Essex St., Rochelle Park, NJ 07662.

A few suggestions: All submissions should be original, typed (*not* all CAPS), double-spaced and neat. Please include your name and address on the first page of the article and enclose a self-addressed, stamped envelope for return of material.

Since we photograph program listings and sample runs exactly as you send them to us for publication in the magazine, please be sure you use a fresh ribbon for computer printouts. If you don't have a printer, you can type your listings single spaced; but again, be sure you use a new ribbon. (If your program relies heavily on graphics, you can photograph sample runs from your CRT. But take care to avoid distortion due to the curve of the screen.)

Feel free to call us if you have any questions or want to discuss specific ideas. We can give you feedback and suggest appropriate slants and approaches.

We're always looking for fresh, original ideas. While these guidelines will help you in preparing material for *Personal Computing*, don't assume we don't want your idea just because it's not mentioned here. Let us and our readers know what *you're* doing with your computer.



HARRY SHERSHOW — Dept. Editor

The MYCHESS-CSC Confrontation at San Jose

As the 1980 Micro-Chess-Championship Tournament at San Jose progressed into the later rounds, an air of mild excitement settled on the participants. The stronger programs were beginning to eye each other with open hostility. Fitted with boxing gloves and head guards they could have passed for a team of heavyweight fighters waiting for the bell. One such contest occurred in the second round when MYCHESS B (latest version of MYCHESS "A") and CSC touched gloves. MYCHESS

Mike Samole VP of Fidelity

had already earned an international reputation as a strong program having done well in various tournaments around the world. Unrated CSC, appearing in public for the first time, had been preceded into the tournament hall by much favorable speculation.

The first round of the tournament had already given a clue that these two programs were well matched and they would be rated as co-favorites for this particular encounter. That assessment was based on the performance of both programs against Atari "A" and Atari "B" in the very first round. Both Atari programs were identical and had been brought to the tournament to help fill the card of contestants and to prevent byes. CSC as White had played against Atari A and won by opponent's resignation after the 48th move (when CSC queen-promoted a pawn). In the same first round, MYCHESS B had played twin program Atari B and had won by mate in 28 moves. Most of the spectators moved toward the demonstration board of this game as MYCHESS B made the first move to begin the contest.

In the time pauses between the moves of this game, (documented and annotated below by George Koltanowski,) we had a chance to interview Dave Kittinger of the MYCHESS program:

Q. *How did you get into computer chess, Dave?*

A. First of all, I'm in the top ten chess players in Alaska. I have a 1900 rating — so obviously there aren't too many good players up there. I've always had an interest in the physical sciences. I went to college for about two years and took only science classes. Didn't bother with the humanities. That's my frame of mind. So a computer fits in well with my objectives. And in chess, because I'm pretty familiar with the game anyway, the computer offered me a really good challenge.

Q. *Why did you write your program for the Cromemco computer?*

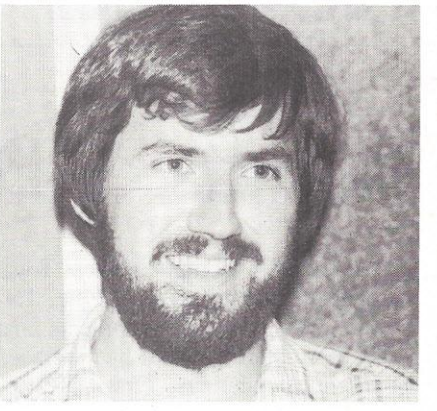
A. A friend of mine in Alaska had an equal interest in computers and we each agreed to buy the same computer so we would be able to swap software, boards, disks and so forth. From the ads, and comparing the different specs, we decided on the Z-80-based Cromemco.

Q. *What programming language did you use?*

A. I used Z-80-processor assembly language because a higher level language would probably be too slow. And in computer chess you're doing a tremendous amount of processing. Sure, it would be possible to write the program in PASCAL or a higher language then go in and write the subroutines or inter-loop stuff in assembly language. And that would probably be more efficient. In assembly-language writing you get so used to looking at the registers that after awhile you can tell them to do just about anything you want.

Q. *How long to write MYCHESS?*

A. I got my computer three years ago last November. Didn't even know then you had to buy a terminal, disk drive and so forth. I was very unsophisticated. Basically, I had a processor



Dave Kittinger of Mychess

board and a power supply and it did nothing. So around March, two years ago, I got my console and some memory. I started to write MYCHESS in May for my own use because up in Alaska I had no one to play chess with. It turned out to be such a good program, I decided to sell it to other people who had the same sort of computers.

Q. *Why don't you have different versions of MYCHESS, as some of the other programs have?*

A. MYCHESS has always been an ongoing improving process. I've always retained the same name for it instead of giving it different version numbers as others do. When I sell a copy of MYCHESS, the customer gets the latest up-to-date version that is better than the previous versions. That's pretty much the way human

chess players improve. You don't talk about the 1977 Karpov; or the 1979 Karpov or the 1980 Karpov. It's still Karpov, except that we know he plays better this year than he did last year. He has improved his game by learning and playing. That is the way MYCHESS improves its game — by continual playing and learning and being revised.

Q. *Is there any way your customers could know which version they have?*

A. Not really. Anybody who's bought MYCHESS within the past year has, basically, the current, best version. So, it wouldn't pay for him to have the program updated. Prior to that year it might pay to have it updated.

At this point Dave was drawn into an audience discussion on tree-searching. We leaned across the table to have a few words with Mike Samole, VP of Fidelity Electronics, who was monitoring his new redoubtable CSC unit.

Q. *Can you tell us something about that CSC unit, Mike?*

A. Well, to begin with, the programming that went into this CSC model has been very extensive. We lined up a special team, headed by our director of engineering, Ron Nelson. He is the engineer who devised the very first chess game for a stand-alone-device. We thought that when all the members of Ron's team had finished — we *thought* the product would do well. We had tested it at the plant and we were amazed at its performance level. We decided, then, to bring it here, as well as take it to London, and put it through a competitive test. While we are talking here, now, I can tell you that our engineering staff is hard at work on even more improved versions of the CSC. Depending on when these new products are developed and released, there is going to become available, through us, greatly improved software for playing chess. Each year you will see improvements in the Challenger game.

Q. *What about the hardware in this unit?*

A. The hardware is pretty much the same as was put into the recently released Voice Sensory Challenger. We use a sensory input. There's no separate numeric keyboard. Simply move the pieces on the chessboard and the unit senses what pieces have been moved and where they're going. This is a relatively new concept in stand-alone-chess-devices. From a hardware point of view the components are relatively new and unique. They are in the VSC units that are reaching the store shelves right now.

Q. *What about the software in the CSC?*

A. I really can't get into the size of the program or any of the other specifics of the software. I can say that the pro-

Results of BIG Tournament

The 11th ACM Computer Chess Tournament (Oct. 25-28 at Nashville, TN) ended with some developments that were more startling than had surfaced in previous meetings. First, BELLE, by winning this tournament on the heels of its victory earlier in the month in Austria, has established itself as the strongest chess program in the world! Secondly, the BLITZ program, playing on the world's most powerful computer (CRAY II machine) finished in a virtual 5th place tie with the strong microcomputer program, MYCHESS. Third, for the first time in the 11-year history of these tournaments, the longest reigning champion of them all, Chess 4.9, failed to make an appearance. And fourth, fifth place CSC, the only commercial stand-alone unit at the tournament finished in a virtual tie for third against the strong BeBe program. Our on-the-scene-correspondent, Evan Katz, will be reporting, in the next issue, some of these developments as well as relaying complete game scores.

1.	BELLE	4 pts.
2.	CHAOS	3 pts.
3. Tie	CSC	2½ pts. (3rd place on tie-breaking points.)
3. Tie	BeBe	2½ pts. (4th place on tie-breaking points.)
5. Tie	Cray II BLITZ	2 pts. (5th place on tie-breaking points.)
5. Tie	MYCHESS	2 pts. (6th place on tie-breaking points.)
7. Tie	OSTRICH 81	1½ pts. (7th place on tie-breaking points.)
7. Tie	Cray I CUBE 2.0	1½ pts (8th place on tie-breaking points.)
9.	AWIT	1 pt.
10.	CLASH	0 pts.

(A better method for arriving at more significant final scores should be developed. One such method could assign "absolute seed values" to each contestant, then using both positive and negative results, earned or lost, a "real value" finish could be obtained. Thus, as an example, BELLE (10) beats CSC (4), and AWIT (6), draws against CRAY II BLITZ (7), and loses to CHAOS (8). BELLE therefore finishes with a point score of +5½. CSC (4) beats BORIS 2.5 (3), beats MYCHESS (2), draws against AWIT (6), and loses to BELLE (10). CSC's point score, then, would be −2. That would be more indicative of the true playing performances and comparisons of the programs, otherwise, Belle and CSC (with 2 wins and a draw) end in a virtual tie with 2½ points. There are probably better ways of creating and using a value table than suggested in this example. Values after program names are agreed upon before game time. Such values would be flexible and would be determined before every tournament, then discarded. —Ed.)

gram is written around the 6502 chip.

Q. *Why did you bring only the CSC unit to the tournament? Where is the Voice Sensory Challenger?*

A. That is probably due to our own misunderstanding. We thought we were only allowed one entry. In the London tournament, I think, they only allowed one entry into the tournament. So we assumed that the same procedure would be followed here. So, we brought our best model.

Q. *Is there anything in the CSC model that is not in the VSC model?*

A. I'm not an engineer. And I can't tell you if there are minor variations here over other models. But I assume that everything in this model is the same as in the VSC model. But again I'm talking off the top of my head, now. Not as a qualified engineer.

Q. *When will the CSC unit — the one here at the tournament — be made available to the public?*

A. The answer to that is **I don't know!** Frankly, it's quite possible that it will be included at the time we normally make our product releases in January. As a matter of fact, the program, when it's released in January may be improved over what it is today. If that happens then there will be a normal four-month delay in introducing the new program into ROM. So, you can see for yourself it would probably be sometime in April or May before it could possibly reach anyone. We may make some improvements and changes — we are discussing right now at our company — based on the fact that there's been a great amount of interest generated by this tournament. And we would, as a company, like to be responsive to that interest.

Q. *What about the price of this model?*

A. No fixed idea yet on the price. But from my own point of view I think it will be in the same price range as our new Voice Sensory Challenger, which has a suggested retail of about $360.

Q. *Can you clear up the speculation on Fidelity's association with Dan and Kathe Spracklen?*

A. Well, I can say that we are very interested in having Dan and Kathe Spracklen come to our company. And we do have a verbal understanding in principle — if you will. But no formal agreement has been reached. We've reached the handshake stage at this time. We had almost counted them as part of our team; in fact, in June of 1980, we were indicating that they **were** part of the Fidelity organization. Since that time, their counsel has suggested that until the litigation with their former employers has been settled, we had better put things in limbo. So, unfortunately, although Fidelity is ready, the Spracklens are in a predicament right now. They're not earning what they would like to be earning and are not formally employed yet. Obviously, we'd love to have them associated with us. But to answer some of the current questions, they are not yet formally employed by Fidelity.

Dave Kittinger ended his involvement in the audience discussion, and returned to his seat to enter CSC's latest move into his computer. We continued our interview with him.

Q. *What about the future of MYCHESS, Dave? We hear a lot of rumors about your coming out with a stand-alone device.*

A. Well, I'm down here now in California working with a company to produce a stand-alone device. I can't name the company at this time or discuss what they're planning to come out with. It's the company's policy. There's a lot of competition around. The market is growing fast and so is the competition. And the company doesn't want to be beaten to the punch. I can tell you that they are coming out with some very sophisticated hardware. Quite frankly, our project puts everything I've seen here at the tournament to shame. There'll be a couple of different versions of the unit, pricewise.

Q. *Will it be just a chess device or will it be a small mainframe with replaceable modules for different games?*

A. I think it will be just for chess. The ROM may be made accessible or replaceable. But, after all, what can you do on a chess board? You can play Othello or Checkers. Perhaps there *are* plans for interchanging board overlays so you can go from Chess to Othello to Backgammon, to Bridge. I don't know

First "Memorial" Plaque to CSC

The Doug Penrod Memorial Award is named after the man who founded the Computer Chess Newsletter (in 1977), first of its kind in the world. Doug Penrod died November, 1978. The Newsletter has been continued, since April, 1978 by PERSONAL COMPUTING. Annual awards of similar plaques are being planned for future winners of this tournament.

Following are the last words Doug Penrod wrote about the Computer Chess Newsletter:

Founding the Computer Chess Newsletter has been a great pleasure for me, though a lot of work, and I hope to help with it as long as I am able. I apologize for the delays and other defects. I expect the newsletter to be useful both to those who are pushing the state of the art at the professional level in the universities, and to the growing army of hobbyists who are just learning about it. I trust that the experienced computer chess programmers will continue to write about it both for their mutual benefit, providing communication to advance the state of the art, and to write tutorial articles for the benefit of those who are trying to write their first program. I look forward to the publication of completely documented programs, modularly constructed to easy modification by the experimenter.

about that yet. One thing I can stress, the MYCHESS program will be upgradeable just as it is now upgraded continually. I can tell you that having seen everything that is currently available on the marketplace, as far as hand-held affordable units are concerned, I'm extremely impressed with the proposed MYCHESS hardware. I think once it comes out and everyone sees it, I think everyone will agree with me. At least, I hope they will. Of course, human nature being so unpredictable, there are probably some people out there who won't agree with anyone on anything.

Q. *How did you get into programming? Did you study that along with your other science courses?*

A. No. I just learned it by working at it. Learned by doing. It's a fairly logical process, or art form or science or whatever you want to call it. There's a language to learn and once you learn the language and know what you want to do and can define your problem then you can go ahead and do it.

Q. *Have you written other programs besides Chess?*

A. Yes. I've written a dis-assembler program, a small Blackjack program, and a couple of accounting-type programs for a firm before I started to work on the MYCHESS program. I don't really like doing those accounting type of programs. I do like chess programming. I may not be getting rich at this, but it's a lot of fun just working on my hobby.

Q. *Are you going to be concentrating on Chess programming, now?*

A. If I stay into chess programming, it will probably be to get one of the new 16-bit microcomputers — probably a Z8000, or an 8086.

Q. *Okay. What if you had a 16-bit micro right now, how would that affect MYCHESS' rating?*

A. MYCHESS has a current rating of about 1600. With a 16-bit-based chip, I think the rating would jump to about 1750.

Q. *What if you also increased the speed to 8 megaherz, would that improve MYCHESS even more?*

A. Well, if I ran the current MYCHESS on 8 megaherz instead of its 4 megaherz, it would probably play twice as fast. You can expect a certain limited increase in its strength. After all, more searching doesn't lead to better play. Right now, at 4 megaherz MYCHESS finishes a four-ply search and gets a little way into the fifth ply. If you double the speed you won't progress that much further into the fifth ply. Generally, each ply you increase requires six times the amount of time of the previous ply. So doubling the speed would certainly help. But you're not helping it to look a *full* additional ply ahead.

Q. *What is the biggest problem you faced in programming MYCHESS?*

A. The whole thing was a big problem. It takes a lot of work. Quiescence, probably, has been the toughest problem. That is the time you stop to evaluate a certain position further. This tends to blow up very quickly — if you open the door just a little. If you do it too selectively, you actually come up with the wrong answer a lot of times. That's probably the biggest problem in chess programming, I think. After a year of struggling with it I still haven't solved it.

Q. *Is the problem solvable?*

A. Well, I don't know whether it is

The Battle of the Chips

Entrants at the London Tournament had previously revealed the chip and memory size of the units being used to run their programs. Those were (in order of finish):

	Program	Chip & Memory Size	Point Finish
	1. CSC	6502, 20K	5
	2. BORIS X	6502, 8K	4
Tie	3. MIKE 3.0	6502, 48K	3
"	3. ROOK 4.0	Z8000, 16K	3
"	3. SARGON 2.0	6502, 24K	3
"	3. GAMBIET	Z80, 10K	3
Tie	7. MODULAR GAME SYSTEM 2.5	6502, 8K	2½
"	7. AUTO RESPONSE BOARD 2.5	6502, 8K	2½
"	7. VEGA 1.7	Z80, 12K	2½
Tie	10. VIKTOR	8085, 8K	2
"	10. ALBATROSS	Z80, 18K	2
	12. FAFNER 2	6502, 16K	1½
	13. PRINCHESS 1.0	6502, 12K	1
	14. K. CHESS IV	Z80, 2.2K	0

The 8085 chip is Intel's enhancement of the 8080A. Some time ago, a group of Intel engineers who had worked in the development of the 8080A (from the 8008), left that company and moved to Zilog where they produced the Z80 as their own enhancement of the 8080A. The two chips, (Z80 and 8085), therefore, are direct descendants of the 8080A and share some of the characteristics of that family. MOS Technology's 6500 chip series is an enhancement of Motorola's 6800. (The μP industry appears to be using each other's products as models for their own enhanced chips.) The 6500 and 6800 agree closely with each other (just as the 8085 and Z80 have similarities) but there is enough difference to prevent using a 6800 program ROM to drive a 6500 CPU. Most powerful chip at the tournament was the fairly new 16-bit, number-crunching Z8000. Its power has obviously not yet been fully realized in microcomputer applications. Otherwise, it should have pushed the ROOK 4.0 program to an easy tournament victory. Apart from their similarities in body structure, the different chips have different instruction sets, varying useful memory registers as well as differing clock speeds (optionally adjustable by the user).

or not. What I usually get, and what most chess programs deliver, is an approximate evaluation. What I'm asking, in the quiescence mode, is there a *perfect* evaluation of the chess position? And that takes a lot more recognition ability — or intelligence, if you will — than I've been able to build into the computer.

Q. *How would you, as the programmer, rate MYCHESS against the other programs, here. Be objective, now, Dave.*

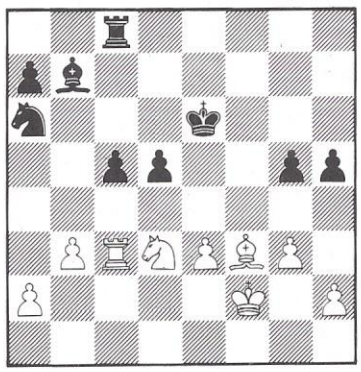
A. Allright. Without any personal bias, I would say that MYCHESS may not be the best microcomputer program against **other** microcomputer programs. But against **humans** it's one of the best, I would say. It played a draw game against Grandmaster Max Euwe.

Q. *What about tournaments like this one, in which you have a chance to test your program against these others with all their claims?*

A. Tournaments like these are fine. But there's just a little too much tension here. Too much commercialization. Companies are looking for good results on which to base future advertising programs. So the relaxation, the exchange of ideas and general camaraderie doesn't exist for many. The commercial entrants are out to help their product make more money. Of course, you can't blame them. They're in business to make money. But a game can go either way even with the best programs. Knowing that creates a lot of tension on the part of some of the entrants. But they do need public expsoure and the public wants to see them in action on a one on one basis. So, I guess we'll have to put up with that tension as long as there's money riding on the outcome. It would probably be nice if every program in a tournament met every other program twice, first as White and then as Black. But that would require probably a week of tournament time, not the three days we have now in which we can just squeeze in four rounds.

MYCHESS "B" (White) vs. CSC (Black)

1 d2-d4	Ng8-f6
2 c2-c4	e7-e6
3 Ngl-f3	b7-b6
5 Bfl-g2	Bf8-e7
6 0-0	0-0
7 Nbl-c3	Nf6-e4
8 Qdl-c2	Ne4×c3
9 Qc2×c3	d7-d5
10 Nf3-e5	Nb8-a6
11 Bcl-d2 (a)	f7-f6
12 Ne5-d3	c7-c5
13 c4×d5	e6×d5
14 d4+c5	b6×c5
15 Ral-d1	Ra8-b8
16 b2-b3(b)	Qd8-d7
17 Bd2-f4	Rb8-e8
18 Rfl-el	g7-g5
19 Bf4-d2 (c)	Be7-d6
20 e2-e3	Qd7-f5
21 f2-f4	h7-h5
22 f4×g5	f6×g5
23 Rel-fl	Qf5-g4
24 Rfl×f8+	Bd6×f8? (d)
25 Nd3-f2	Qg4-f5
26 Qc3-d3	Qf5×d3
27 Nf2×d3	Bf8-g7
28 Rdl-fl	Re8-f8
29 Rfl-cl	Rf8-c8
30 Bd2-c3	Bg7×c3
31 Rcl×c3	Kg8-f7
32 Kgl-f2	Kf7-e6
33 Bg2-f3 (e)	Rc8-f8
34 Kf2-e2	Rf8×f3!
35 Nd3×c5+	Na6×c5
36 Rc3×c5	Rf3-f7
37 e3-e4	Ke6-d6
38 Rc5-a5	d5×e4
39 Ra5×g5	Rf7-h7
40 Ke2-e3	Bb7-c6
41 Rg5-g6+	Kd6-d5
42 Rg6-g5+	Kd5-e6
43 Rg5-g6+	Ke6-d7
44 Rg6-f6	Kd7-c7



After White's 33rd move

45 Rf6-f5	Kc7-d6
46 Rf5-f6+	Kd6-d5
47 Rf6-f5+	Kd5-e6
48 Rf5-c5	Ke6-d6
49 Ke3-d	a7-a6
50 Rc5-a5	Bc6-b7
51 Ra5-f5	Kd6-e6
52 Ff5-e5+	Ke6-f6
53 Re5-e8	Rh7-d7+
54 Kd4-e3	Rd7-d3+
55 Ke3-e2	Bb7-c6
56 Re8-f8+	Kf6-g7
57 Rf8-f5	Bc6-b5
58 Ke2-el	Kg7-g6
59 Sealed move	
59 Rf5-e5	e4-e3
60 Re5-e4	Rd3-c3
61 Ke1-d1	e3-e2+
62 Kd1-d2	Rc3-c6
63 Re4-e5	Rc6-d6+
64 Kd2-e1	Rd6-d1+
65 Kel-f2	Rd1-f1+
66 Kf2-g2	Bb5-c6+
67 Kg2-h3	e2-e1=Q
68 Re5×e1	Rf1×e1
69 b3-b4	Kg6-g5
70 b4-b5	a6×b5
71 a2-a3	Re1-e2
72 g3-g4	Re2-e3++ (f)

The Cray-1 Plays Chess
(Part 1)

BY ROBERT M. HYATT
University of Southern Mississippi

Computer chess has become popular in the past ten years and has been advertised as an answer to the question "can a computer really think." An annual tournament organized by the ACM has the sole purpose of determining the best computer chess program/machine in North America. Another tournament held every three years determines the best computer chess program/machine combination in the **world.** In the past, these events have been dominated by the "super computers" such as the CDC CYBER 176, AMDAHL 470/V8, and large IBM computers. Usually, the fastest machine has won, which prompts a lot of scurrying around by each programming team to locate the fastest possible computer for the next tournament. Until now the CRAY-1, even though it is the premier "super computer", has not participated although this may change in the near

future. (A Cray machine was listed as probably playing in the Sept. world tournament and the Oct. ACM tournament — ed.)

Computer chess, always considered an "intellectual" exercise, has sparked a lot of interest in developing the best computer chess program possible. There have been two basic techniques proposed for computer chess programs.

The simplest algorithm is referred to as the "Shannon Type A" algorithm, or more commonly as an exhaustive or brute-force search. This technique examines **all** possible sequences of moves to some fixed depth and then examines checks or capture sequences until reaching a "quiet" position that can be correctly evaluated by a static evaluation routine. This approach has a serious drawback in that a large number of nodes or positions must be analyzed for a relatively shallow search depth. For example, a 6 ply or half move search, even if properly ordered, could include over one-half million nodes or even more. Until the advent of the "super computers", this approach was abandoned as completely hopeless.

The second approach is referred to as the "Shannon Type B" algorithm, or more commonly as a selective search. This technique attempts to search fewer moves for each side, and therefore searches much deeper than the exhaustive search. This is esthetically pleasing since it more nearly approximates the human thought process. With this approach, the program will generate all legal moves for each side, but will discard most of them and only search a small subset. While this seems simple and logical, it is extremely difficult if not impossible to properly implement such a scheme. However, until the late 1970's this approach was used by practically everyone which accounted for the relatively poor performance of the programs of that era.

With the arrival of "super computers", the Type A programs once again became popular due to the simpler algorithms required, and at the same time, these programs became quite successful in both human and machine competition. The major advantage of this technique is that it is more nearly an algorithmic approach which pits the blinding speed of these "super computers" against the reasoning power of the human mind. Since 10 MIPS computers are common, these programs (which were rejected in the past as

hopelessly inadequate) have surprised everyone by breaking into the expert chess rank (USCF rating over 2000) and are even threatening to become chess masters, something that had been labeled as impossible as recently as five years ago. BLITZ uses this approach with many extensions that will be described later.

Computer chess tournaments are somewhat unusual in the way they are organized. First, they occur at a large gathering of computer-related people, such as the ACM or IFIP conferences. Each game takes place on a long table with a computer terminal at each end and a regulation chess board in the middle. When a program announces a move, the human operator makes the indicated move on the board. At this point, the operator for the opposing program enters that move and waits on his program to supply a response. This process continues until the game is over.

The games draw audiences of over 500 enthusiastic people that boo, hiss, applaud, complain, kibbitz, and otherwise enjoy this most unusual happening, (Note: noise doesn't bother the players as in a human chess game!) There are usually many journalists present and at least once during the tournament local TV news crews pop in to see what is happening.

BLITZ has a neat method of making its move and determining what the opponent moved without requiring very much from its operator. A special chess board with magnetic switches and lamps under each square simplify the operator's duties. When a piece is moved, a microprocessor detects the move and transmits it to BLITZ. When BLITZ announces a move the microprocessor illuminates the lamps under appropriate squares to indicate which piece should be moved and where. This eliminates the possibility of human error in inputting moves or in making moves on the board, and also adds a touch of class to the program since everything but moving BLITZ's pieces is automated. (This also is being studied and may not be true much longer!)

BLITZ has been competing in computer chess tournaments since 1976, and has usually finished in the top three or four at each match. It has been a Shannon Type A program since 1978, but has many unique features to make the statement that BLITZ is simply a "Northwestern CHESS 4.9 clone" erroneous.

BLITZ has an evaluation function composed of several thousand FOR TRAN IV statements. Where other Type A programs use fairly simple evaluation functions for greater speed, BLITZ contains a broad base of chess knowledge that allows it to compete with programs that run on much faster computers.

BLITZ is written entirely in FORTRAN IV so that it can be run on the fastest computer available (such as the CRAY-1, CRAY-2, or CRAY-N). It has not been written around a particular architecture or word size, but is a truly general algorithm that can utilize any reasonable computer system.

Since BLITZ has been developed on a computer that is at least 25 times slower than the CRAY-1, a great deal of time has been invested in finding the most efficient way to conduct the game tree search. The program played BELLE for the championship in 1978 in Washington, D.C., and made it that far on a UNIVAC 1100/40 system that runs only three times faster than the development computer. The CRAY-1 offers a significant performance increase as a performance analysis will show.

BLITZ has competed in human chess tournaments and has compiled a USCF rating of 1690 running on the campus XEROX SIGMA 9 computer system. This compares to CHESS 4.9 with a rating of 1567 running on a faster CDC 6400 computer. When moved to the CDC CYBER 176 computer, which is 10 times faster than the CDC 6400 system, CHESS 4.9 increased it's rating to 2040. BLITZ seems to be as strong in tests conducted on the CRAY-1, which tests show is at least 25 times faster in raw computing power, not counting the larger memory size and potential vector operations that can provide even more speed. Using the above data to extrapolate a rating for BLITZ on the CRAY-1 yields the following:

$$\frac{2040 - 1567}{10} = \frac{X - 1690}{20}$$

Solving for X gives a projected rating of 2636, a highly ***unlikely*** value. You might also note that a ratio of 20 was used in comparing the SIGMA 9 to the CRAY-1, which is actually low. While this rating **is unreasonable,** it shows clearly that BLITZ will not be a"fish" when running on the CRAY-1, but will be a serious threat to both man and machine.

(Continuing parts of this discussion, in subsequent issues of PC, will compare BLITZ's end-game capability — playing on the CRAY machine — against CHESS 4.9's and BELLE's performances)

News on "Intelligent" Games of Backgammon, Checkers, Gomoku, Go, etc., welcomed by this department. Computer Chess and Computer Bridge appear separately. Address all correspondence to Computer Games Dept., Personal Computing.

Correction

The October-issue article by Dr. Foster ("Six Test Problems for Computers") had two errors in the test problems. In diagram 5, the white pawn on c5 should have been on e5. In Diagram 6, a black Bishop on g4 was omitted. We would like to hear from anyone who was able to solve these two problems as originally presented. Solutions for all six problems are:

1	1 QxBPch!	RxQ
	2 R—K8ch	R—B1
	3 RxRch	KxR
	4 R—K8 mate	
2	1 QxBPch!	NxQ
	2 BxN mate	
3	1 QxPch!	RxQ
	2 B—N6 mate	
4	1 N—B7ch	K—B1
	2 Q—Q8ch!	BxQ
	3 R—K8 mate	
5	1 R—B8!	RxR
	2 RxR	BxR
	Or 2 . . .QxR; 3 Q—K7 mate.	
	3 QxQ mate	
6	1 QxBch!	KxQ
	2 B—K2 mate	

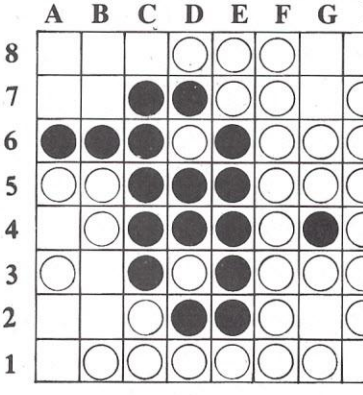
A Computer Program Defeats the US Othello Champ

In round 4 of Northwestern University's Othello Tournament, organized by Peter Frey, Jonathan Cerf (US Othello Champion) played against Dan and Kathe Spracklen's computer program. That particular game, won eventually by the computer, has been scrutinized by Prof. Frey who writes: "I have carefully analyzed that game. It is interesting because Cerf lost it quite early because of his poor positional play. As a matter of fact, after the Spracklen's 23rd move, the game is objectively over. Cerf has no further opportunity to win from that point on unless the computer makes a mistake. I have gone over the game with my own revised program in which the program played Cerf's side of the game. My program disagrees with Cerf on over 50% of the move choices. It appears that his game was simply not one of Jonathan's best (otherwise he would not be the current US Othello champ.) I suspect that he will do much better in a rematch." That particular game follows. (Hiroshi Inoue, from Japan, the world's champion, finished first with 6 points; the Spracklen program, known as REVERSAL was second with 5 1/2 points; Jonathan Cerf came in third with 5 points.)

Spracklen (Black)	Cerf (White)	Stone count
1. f4	f3	3-3
2. e3	f5	3-5
3. g6	f6	4-6
4. g5	c3	5-7
5. e6	g4	6-8
6. f2	e2	8-8
7. d3	c4	9-9
8. h4	h6	9-11
9. h5	h3	9-13
10. g3	h7	8-16
11. d1	f1	7-19
12. d2	f7	8-20
13. e1	c1	5-25
14. b4	g1	9-23
15. d6	d7	8-26
16. c2	h2	9-27
17. c6	b1	8-30
18. e8	b5	9-31
19. c5	d8	10-32
20. e7	f8	15-29
21. c7	a3	13-33
22. a6	a5	14-34
23. b6	(see diagram)	
	c8	10-40
24. a4	a7	10-42
25. b2	a1	9-45
26. g7	g8	8-48
27. b3	a2	8-50
28. h8	Pass	13-46
29. h1	Pass	20-40
30. g2	Pass	27-34
31. b7	b8	31-32
32. a8		39-25

Black: REVERSAL (SPRACKLEN) VS
White: JONATHAN CERF (U.S. CHAMPION)

Position after 23.b

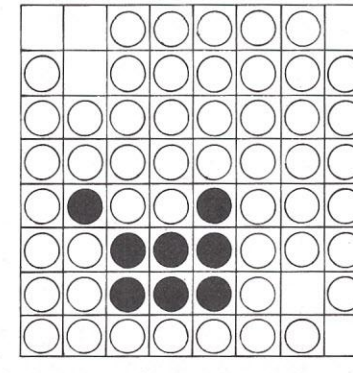


"At this stage of play, the outcome is not in doubt, even though Cerf (White) is ahead on stone count. Only a blunder by the program would give Cerf a win. By computer analysis, one can demonstrate that there is no sequence of moves that Cerf can select that cannot be countered by the Spracklen's program." — P.F.

"Never Over Until The End."

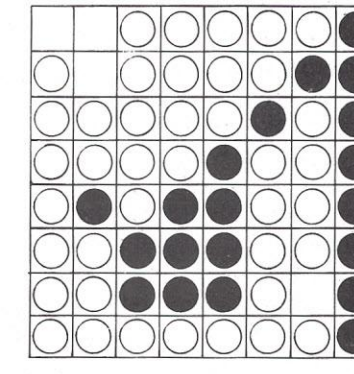
Unlike chess, where material superiority usually means a won game, Othello changes rapidly with every move. This dynamic quality gives the game a rapid-transit quality, an activity lacking in somnolent games such as chess, checkers, and GO. Like large fields of grain rustling in the wind, a board of Othello stones is in constant motion as it grows larger and more restless. The following diagrams, from the last part of the preceding Cerf-Spracklen game, show how dramatically the game changes in just 4 1/2 moves! These fast "turnovers" also make "Othello" a very active game.

Position after move 27



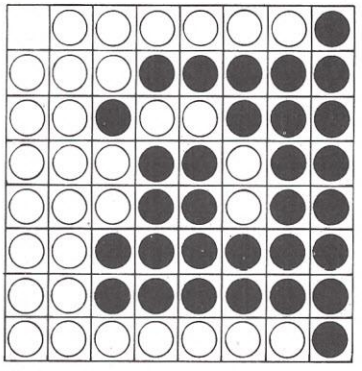
Black seems to have sunk to its lowest point. In despair it finds itself surrounded by a sea of White pawns. Down 50 to 8, with only 5 full moves left, the computer appears doomed.

Position after move 29



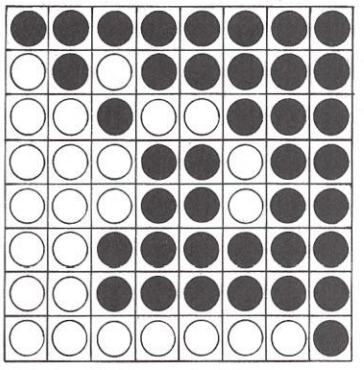
Only four moves left, the Spacklen's program appears to be gaining strength. In two moves the score has gone from 50:8 to 40:20, still in favor of Cerf.

Position after move 31



With one move left, the REVERSAL program has now practically equalized its position, 31:32. (Only one stone down.)

End of game, after White's 32rd move



On the final move of the game, the REVERSAL program prevails 39:25. Cerf has now lost ths game by 14 points!

YOUR COMMENTS .....

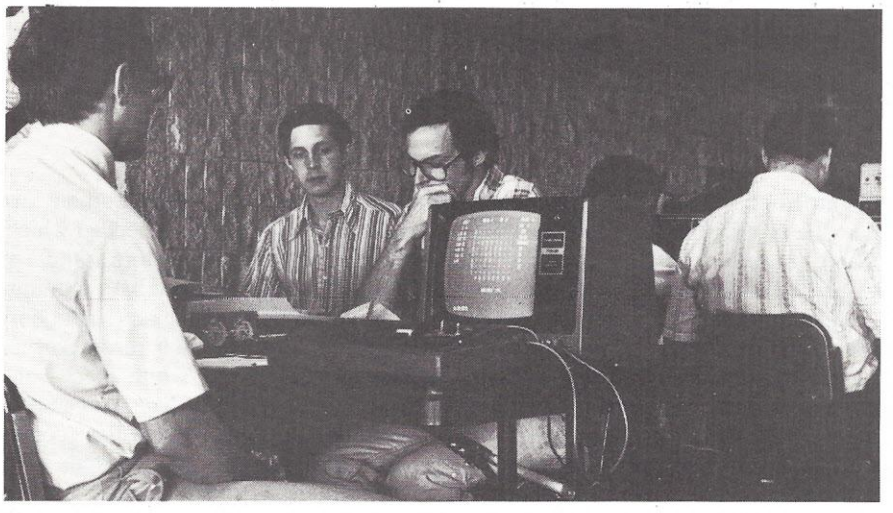
This department discusses the whole activity of "intelligent" games. Such games are Backgammon, Checkers, Gomoku, Go, Othello, etc. Usually, intelligent games involve tree-search programs. However, some intelligent games are based on logic and logical decisions; such as, Prisonner's Dillemma. This department, therefore, welcomes all news on such "games." Address all correspondence to Computer Games Department, PERSONAL COMPUTING.

Notes at a Tournament

Participants at the First International Man-Machine Othello Tournament (Northwestern University, June 19) included the world champion Hiroshi Inoue, and Jonathan Cerf, (United State champion and second place finisher for the world championship.) The tournament was arranged by Peter W. Frey, Northwestern psychology professor and author of a number of computer-chess publications.

"About one and a half months ago," explained Frey, "David Levy, International Chess Master and director of tournaments for the International Computer Chess Association, said he was coming to the States and wanted to play his Othello computer program against mine. We decided to hold a tournament quickly and sent out invitations. I never expected to be able to get the number one and two world players involved in the tournament. Once they agreed to play, we had people banging on the door trying to enter their programs in the tournament."

Othello is similar to the Japanese game "Go" and to strategy planning in chess and backgammon. The difference between the games is ease of learning the rules, which makes it enjoyable for children as well as for adults. "A minute to learn, a lifetime to master, " claims Gabriel Industries of New York, the game's manufacturer. Gabriel also advises players to eat and sleep between matches because they believe the game is that addicting. The more you play, the more strategy you learn.



Paul Rosenbloom, of the Carnegie-Mellon Othello program ponders a move against Peter Frey's Northwestern program.

In the tournament itself Inoue was beaten by a computer program for the first time. A Japanese computer programmer, Inoue has designed Othello computer programs. He says he wins 80 percent of the time. Inoue intends to bring the programs and records of the match he lost to Japan for further study there. He began playing Othello seven years ago.

Cerf, covering an Othello tournament four years ago on a free lance writing assignment decided to learn the game. "Othello isn't as deep a game as chess or backgammon," he said. In contrast to Inoue, Cerf writes elementary mathematics textbooks rather than computer programs.

Cerf competed against Inoue in Rome earlier last year and lost all four matches. "He clearly knows more than I do," Cerf said. "But I'll keep playing as long as it's still fun." "Sitting behind a computer is a lot less anxiety provoking than playing the game yourself," Frey said.

While the opponent is deliberating a move, the computer projects the player's optimum choice and determines the best response to that situation. Frey calls this "thinking on your opponent's time."

Frey became interested in Othello when his children received the board game as a present, a year and a half ago. "I think it's a beautiful tool for studying complex decision-making processes," Frey said. "Eventually Othello will become a better game because computers are competing in the tournaments."

Participants at the tournament learned a great deal about the game, Frey said. After playing against Inoue during the first half of the tournament, Frey changed his program at lunch break. He may again revise his program based on new knowledge gained from that tournament.

"Most people who wrote the computer programs really didn't know how to play the game," said Paul Rosenbloom, a graduate student at Carnegie-Mellon University in Pittsburgh.

"But we fulfilled our hopes," countered Bruce Ladendorf, Rosenbloom's assistant. "We lost to humans, but we beat some of the machines. People just aren't as good as computers. Computers don't blunder."

Kathe and Dan Spracklen of San Diego, Calif., also submitted a computer program. They are authors of the current world championship microcomputer chess program. She was the only woman competitor in the tournament, but she said, "It doesn't bother me. I'm used to it as a math major, and it's the same way at chess tournaments." In fact, the Spracklen program finished ahead of Cerf. The computer program that Cerf feared most was the Spracklens', he had said. While in California several weeks earlier, Cerf had played against their program, and suggested improvements. The computer program they entered in the tournament was much stronger than the one Cerf had previously played, and it came back to haunt him. "You lost to yourself, Jon," Kathe Spracklen crowed as the last stone was flipped.

"Computers have several obvious advantages over human competitors," Cerf said. "Computers think ahead better, they don't make careless errors, and they play the end game very well." Both human players lost to computers after lunch. "You're sitting on a full stomach, and there's less blood supply to the brain," Frey said, in a professional diagnosis. "You don't think as well."

"Computers don't have the flexibility of human players," Kathe Spracklen commented later. "Humans are able to make the most of their opponent's weaknesses, but computers can only make the generally optimum move. They are not able to 'psych out' their opponents."

"It doesn't surprise me that the computers lost," gloated Barry Schwartz of Gabriel Industries, cosponsor of the tournament and promotor of the non-mechanical board game. "The programmers are more skilled in computers than in the game."

With TV and Press people ogling them, Dan and Kathe Spracklen, test their Othello program (marketed by Hayden Co.,) at Peter Frey's first computer-Othello tournament at Northwestern University.

(This report was extracted from an item in "Northwestern University News," Evanston, IL.)

New Program

Newest Othello program on the market is Jamin Chen's program, written in Applesoft Basic. "My program can be played by two people just as they would play with a regular Othello board," writes the author. "The program keeps a running score for the game and acts like a judge rejecting illegal moves. One also has the option of playing against the computer. The computer strategy has only one level but it has been made more powerful by giving extra weights to the playing pieces depending on their positions on the board. These weights can be either negative or positive. Three standard sets of weights are given. In addition there is an option for the player to define his own weights for the program. The computer can be keyed to play against itself with, of course, different strategies for the two sides. This option is very useful for developing a new strategy. Because the program is written entirely in Applesoft Basic, it is easy for most people to modify it to make it special to their own inclinations; e.g., adding their own strategies. Only 16K is needed which I think is an attractive feature as there are a lot of people with the bare minimum 16K machine and with tape input only. The graphics are high resolution and include black and white pieces on a green board — just like your real-life Othello set. Longest time for a computer move response is 17 seconds." The cassette is $15. For further information, write to Jamin Chen, Chen & Co., PO Box 353, Pine Brook, NJ, 07058

New Goren Bridgemaster

BY THOMAS A. THROOP

First, I'd like to present a couple of deals played by Tryom's new Goren Bridgemaster and, second, discuss a couple of interesting deals played with the TRS-80 program I have developed with Bob Hamman.

As I mentioned in my September 1980 column, Tryom's new Goren Bridgemaster is a dedicated electronic bridge playing product which will bid and play 1, 2, 3, or 4 of the hands of a bridge deal, with human players bidding and playing the other hands. One of the very attractive features of the Bridgemaster is that it is programmable with different cartridges; that is, as new bidding and/or playing cartridges are developed by Tryom, these may be used with the same unit.

Just as in the case of Fidelity's Bridge Challenger, the deals the Tryom Bridgemaster is to play are entered into the computer by optically scanning actual cards with coded markings or by typing in the cards via the keyboard.

Here's the first deal from Bridgemaster:

NORTH (Dummy)
♠ AT97632
♥ J5
♦ K4
♣ J8

WEST
♠ —
♥ T98
♦ QT852
♣ AT532

EAST
♠ Q
♥ K7643
♦ 963
♣ K976

SOUTH (Declarer)
♠ KJ854
♥ AQ2
♦ AJ7
♣ Q4

The bidding, with the Bridgemaster playing all four hands is:

Bidding

South	West	North	East
1S	Pass	4S	Pass
Pass	Pass		

The Bridgemaster, as South, opens the bidding with 1 spade. As West, the Bridgemaster passes. With the North hand the Bridgemaster now makes a good bid of 4 spades, which becomes the final contract.

West opens the ace of clubs against the 4 spade contract and continues with the deuce of clubs, which is won by East's king. East now plays a heart, choosing the 7 rather than the 4 or the 3 for some reason. South properly plays the deuce, finessing East for the king. West plays the 8, and North wins the trick with the jack. Next, the 2 of spades is led from the dummy, East follows with the queen, and South wins with the king, while West discards the 2 of diamonds.

At trick 5 South cashes the ace of hearts and then leads the queen, ruffing this in dummy with the 3 of spades. Next, dummy's king of diamonds is cashed, followed by the 4 of diamonds to South's ace. With only trumps remaining in the dummy, the last five tricks are won easily by North-South. Thus, 11 tricks are won by North-South, making the 4 spade contract with an overtrick.

Here's the play of the cards just described:

	W	N	E	S
Trick 1	AC	8C	6C	4C
2	2C	JC	KC	QC
3	8H	JH	7H	2H
4	2D	2S	QS	KS
5	9H	5H	3H	AH
6	TH	3S	4H	QH
7	5D	KD	3D	7D
8	8D	4D	6D	AD
9	TD	6S	9D	JS
10	QD	7S	6H	JD
11	3C	9S	KH	4S
12	5C	TS	7C	5S
13	TC	AS	9C	8S

Contract: 4 spades
Tricks N-S: 11 Tricks E-W: 2

Here's the second deal from the Bridgemaster:

NORTH (Dummy)
♠ 9653
♥ AT854
♦ T
♣ 542

WEST
♠ A4
♥ J963
♦ J87632
♣ 6

EAST
♠ KQT82
♥ KQ72
♦ K4
♣ KT

SOUTH (Declarer)
♠ J7
♥ —
♦ AQ95
♣ AQJ9873

The bidding, with the Bridgemaster playing all four hands is:

Bidding

South	West	North	East
1C	Pass	1H	Double
2C	2D	3C	Pass
4C	Pass	Pass	Pass

South opens the bidding with 1 club, West passes, North responds 1 heart, and East makes a takeout double. South rebids 2 clubs, West bids 2 diamonds, and North bids 3 clubs. East now passes, and South bids 4 clubs, which becomes the final contract. The bidding is all quite reasonable, although perhaps South should bid 5 clubs over North's 3 clubs, rather than bidding only 4.

Against the 4 club contract West opens the 8 of diamonds, the ten is played from North, East plays the king, and South wins the trick with the ace. At trick 2 the Bridgemaster correctly leads the 5 of diamonds from South, ruffing with dummy's deuce of clubs, and then cashes dummy's ace of hearts, discarding a losing spade from South's hand.

The Bridgemaster now leads the 4 of hearts from North, East plays the

queen, and South ruffs with the 3 of clubs. Now the 9 of diamonds is led from South and ruffed with dummy's 4 of clubs, but this is over-ruffed by East with the ten of clubs. East now cashes the king of spades and then shifts to the king of hearts, which is ruffed by declarer's 7 of clubs. South next plays the ace of clubs, drawing the enemy trump, after which the rest of the tricks are won by declarer's queen of diamonds and remaining trumps.

Here's the play of the cards just described:

		N	E	S
Trick 1	8D	TD	KD	AD
2	2D	2C	4D	5D
3	3H	AH	2H	7S
4	6H	4H	QH	3C
5	3D	4C	TC	9D
6	4S	3S	KS	JS
7	9H	5H	KH	7C
8	6C	5C	KC	AC
9	6D	5S	2S	QD
10	7D	8H	8S	JC
11	JD	TH	7H	QC
12	JH	6S	TS	8C
13	AS	9S	QS	9C

Contract: 4 clubs
Tricks N-S: 11 Tricks E-W: 2

Now let's look at a couple of deals played by my TRS-80 at the time of writing this column. The first deal is as follows:

NORTH
(Dummy)
♠ A62
♥ AKQ
♦ T74
♣ A543

COMPUTER WEST
♠ J4
♥ J63
♦ AQ65
♣ QT86

COMPUTER EAST
♠ Q987
♥ T842
♦ K2
♣ 972

SOUTH
(Declarer)
♠ KT53
♥ 975
♦ J983
♣ KJ

This is deal number 861 generated by the pseudo random number dealing routine of the program. As I have mentioned in my earlier columns discussing the program, you play the North-South cards at a contract of your choice, while the computer program defends with East-West cards.

The program recommends 3 no trump as the contract for you to play with the North-South cards. Against this contract the computer, as West, opens the 5 of diamonds, you play the 4 from dummy, and East wins with the king. East returns the deuce of diamonds, you play the 8 from your hand, and West wins with the queen. West cashes the ace of diamonds and then leads the 6 of diamonds, which you win with your jack, discarding the 3 of clubs from dummy. On this trick East discards the 2 of clubs.

You now have 8 top tricks. Your best chance for the ninth trick is in the spade suit, in which you hope that the enemy spades are divided 3-3 or that East has the long spades. Thus, your plan is to

cash the ace and king of spades and then lead a spade from dummy toward your guarded ten of spades. Suppose, therefore, that you now play a spade to dummy's ace, a spade back to your king, a heart to dummy's queen, and then lead the 6 of spades from dummy. If East plays his spade honor, you will play low and your ten of spades becomes the ninth trick. If East plays the spade 9, you will cover with the ten. If this loses to West, then the 5 of spades is your ninth trick.

On the lead of the spade 6 from dummy the TRS-80 program plays the queen of spades from East. The remaining tricks are now yours. Here's the complete play of the cards:

	W	N	E	S
Trick 1	5D	4D	KD	3D
2	QD	7D	2D	8D
3	AD	TD	2H	9D
4	6D	3C	2C	JD
5	4S	AS	7S	3S
6	JS	2S	8S	KS
7	3H	QH	4H	5H
8	6C	6S	QS	5S
9	8C	4C	9C	KC
10	6H	5C	9S	TS
11	TC	AC	7C	JC
12	JH	KH	8H	7H
13	QC	AH	TH	9H

Contract: 3 no trump
Tricks N-S: 9 Tricks E-W: 4

The second deal played by my TRS-80 program is a most interesting one. It is deal number 856. Here are cards for your hand and the dummy:

NORTH
(Dummy)
♠ A92
♥ AK2
♦ QJ763
♣ T7

SOUTH
(Declarer)
♠ K86
♥ T7
♦ T9
♣ AKQ643

The computer program recommends 3 no trump as the contract for you to play with the North-South cards. Against this contract the computer, as West, leads the 4 of hearts. With any reasonable club split you have 10 tricks off the top, 6 clubs, 2 spades and 2 hearts. Suppose you were playing in a tournament event where each overtrick was important. How would you play to take 11 tricks with these cards?

For those of you who have the TRS-80 program, why don't you play this deal a few different ways before reading further and see how the computer defends? When I played this deal, I decided to see if a squeeze could be set up against West or East, whichever might hold the queen of spades together with one (or both) of the top diamond honors.

On the opening lead of the heart 4 I played the king from dummy, East played the 9, and I played the 7 from my hand. Then I played the 7 of clubs from dummy to my ace, on which West

played the jack. At this point it looked like West began with five hearts and one club, leaving him seven cards in spades and diamonds, and East began with three hearts and four clubs, leaving him with six cards in spades and diamonds. This gives West a slightly greater chance of holding the majority of the outstanding spade honors.

On the above reasoning, I now played the 9 of diamonds from my hand, hoping that West would duck if he held one of the diamond honors. If he should hold both top honors, he should play one of them but not cash the second honor. On my 9 West played the 5, I played the jack from dummy, and East won with the diamond king.

At trick 5 East now led the queen of hearts. To set up the possible squeeze, I let East hold this trick, refusing to win it with the ace of hearts. East continued with the jack of hearts, dummy's ace winning this trick. I next cashed the ten of clubs in dummy, on which west discarded the 5 of spades, entered my hand with the king of spades, and ran my four remaining clubs. On the lead of the last club West was squeezed, as this was the situation:

NORTH
♠A9
♥ —
♦ Q
♣ —

WEST
♠ QJ
♥ —
♦ A
♣ —

EAST
♠ 7
♥ —
♦ 42
♣ —

SOUTH
♠ 8
♥ —
♦ T
♣ 4

West was helpless. The computer elected to discard the jack of spades, giving me the last two tricks with the ace and 9 of spades. If West discards the ace of diamonds, then the last two tricks are won with the ace of spades and queen of diamonds. Thus, I made 11 tricks for two overtricks.

The squeeze could have been prevented by some inspired defense at trick 4 or trick 6, but, after all, the computer program is human!

Here's the complete deal and the play of the cards:

NORTH
(Dummy)
♠ A92
♥ AK2
♦ QJ763
♣ T7

COMPUTER WEST
♠ QJT5
♥ 86543
♦ A85
♣ J

COMPUTER EAST
♠ 743
♥ QJ9
♦ K42
♣ 9852

SOUTH
(Declarer)
♠ K86
♥ T7
♦ T9
♣ AKQ643

	W	N	E	S
Trick 1	4H	KH	9H	7H
2	JC	7C	2C	AC
3	5D	3D	KD	9D
4	3H	2H!	QH	TH
5	5H	AH	JH	6S
6	5S	TC	5C	3C
7	TS	2S	3S	KS
8	8D	6D	8C	KC
9	6H	7D	9C	QC
10	8H	JD	4S	6C
11	JS	QD	2D	4C
12	QS	AS	7S	8S
13	AD	9S	4D	TD

Contract: 3 no trump
Tricks N-S: 11 Tricks E-W: 2

Thomas Throop has been involved in Computer Bridge since 1959 when he wrote a bidding program in machine language on a Univac I. In 1970 he constructed a declarer-playing program in FORTRAN which ran on two time-sharing systems. That program is still being used. Mr. Throop started playing bridge in 1958 and five years later he was a Life Master. He has played serious bridge against notable personalities such as Charles Goren, Helen Sobol, Oswald Jacoby and Alfred Sheinwald. He has also played against two members of the world championship Italian Blue Team.

Learning About Your First Computer

Your First Computer, by Rodnay Zaks; Sybex, Inc., 2344 Sixth St., Berkeley, CA 94710; 258 pp.; $7.95 paperback.

Microcomputers may soon wake us up in the morning, heat our coffee, turn on the lights, warm up the car and write our business letters. What do we really know about microcomputers? How do they work? How important is it to learn how to use them? These are important questions in this era of computerization and *Your First Computer* by Rodnay Zaks may help answer some of them for you.

This book, a step-by-step learning approach to computers, guides the novice through computer hardware, system selection and discussions of the different languages available.

Zaks starts the book with a futuristic, but plausible, scenario of a family using computers in almost every daily situation. Most of the described applications are technically possible now, but for economic reasons they have not yet been used on a large scale. "We can, however, safely predict that a large number of applications will be implemented within the next decade. And, many improvements will be available that cannot even be imagined at this point, " explains Zaks. He also discusses computerized shopping, office appointment calendars, report generation, mechanized cooking, computer-aided instruction, electronic cars, home control of lights and security.

In the succeeding chapters, Zaks teaches you how to use a microcomputer system: connecting the system and implementing a program. He shows you how a microcomputer can solve your business problems, how a microprocessor is manufactured, how a system works and examines functional elements of a microcomputer system such as the central processing unit (CPU), the busses, the memory and input-output devices.

In Chapter 5, Zaks introduces programming with a simple definition: "A program is a sequence of orders or instructions to a computer that will solve a specific problem." He goes on to explain in easy-to-understand terminology, flow charts, information representation in a microcomputer, logical operations, external representation, development of a program and the required software for program development.

Continuing on the preceding chapter's discussion, Chapter 6 introduces high-level languages including Basic, Pascal, Cobol, Fortran and APL. Zaks provides a summary of Basic statements and their explanations, and gives an example of a simple Pascal program.

Chapter 7 details the business computing capabilities now available for a microcomputer system. Zaks discusses the different kinds of software needed for business applications, including accounts receivable, accounts payable, inventory and mailing lists. He explains how you should use your system to best solve your business problems.

The following three chapters discuss how you select a system that best suits your needs, the peripherals that you might want to look at and the different kinds of microcomputers on the market today. Zaks presents the many options you will have to choose from and gives a brief history of the industry.

The last few chapters deal with the economics of owning a system and the different resources available for information such as magazines and computer clubs.

The book also includes detailed appendices for technically oriented readers as well as a list of names and addresses of manufacturers.

— Reviewed by Elli Holman

Directory of Apple Software

Skarbeks Software Directory, published by Skarbeks Software Directory, 11990 Dorsett Road, St. Louis, MO 63043; (314) 567-3292; 364 pp.; $11.95 paperback. Available from local computer stores or directly from the publisher.

Finding software presents a perpetual problem. You study the magazines, read the ads, write for the catalogs and — if you're lucky — find just the program you need. But wouldn't it be wonderful if *all* the programs available for your machine were listed in one convenient volume you could peruse at leisure?

Well, "all" is impossible in this exploding field, but Apple owners have the next best thing in *Skarbeks Software Directory*. The publishers have collected descriptions of more than 800 Apple programs (and many peripherals) from over 100 vendors in this 364-page book.

Each listing includes program title, publisher, memory requirements, program description and price. Language and hardware requirements are often included as well. Publisher addresses are given in the back of the book.

An added feature of the book is a summary of Apple control and editing characters and disk commands, and a glossary of computer terms.

Listings are arranged alphabetically by title from "A Stellar Trek" to "Z-80 Softcard," plus an additional section of "Better Late Than Never" entries. Since program titles often don't reveal the program's application, the publishers increased the book's usefulness with a subject index. This index lists program titles under a number of broad categories: Education, Business, Peripherals, Engineering, Music, Data Base, Medical, Gambling, Special Interest, Programming and Systems Software, Personal, Math, Word Processing, Sports, Home, Accessories,

BOOKSHELF

Graphics, and Game. Thus by scanning the index and flipping back to the program descriptions, you can fairly quickly locate particular software of interest.

You can also use the book to generate application ideas for your computer. Browse through to see what others have done and you're bound to think of new uses for your Apple.

Programs covered range from commonplace games such as "Lunar Lander," "Craps" and "Star Wars" to esoteric applications such as "Bone Tumor Differential Diagnosis" and "Active Filter Design." But in between are hundreds of useful programs, including numerous versions of payroll, accounting, mailing list, data base and inventory programs, plus utility programs and software for personal and eductional use.

According to the *Directory's* introduction, software descriptions were taken from information supplied by the software publishers. So these are *not* software reviews; you can't use the descriptions to judge the software's quality or suitability for your particular application, except in a general sense. You may need to do further checking before you buy a particular program.

Also, the descriptions are sometimes sketchy. For example, under a program called "Save the World," the description reads simply: "It's in your hands. You'll need all your skill." And "Kidstuff" is described as "Delightful assortment of puzzles, riddles, jokes, mazes and brain-teasers created for your kids by our kids."

On the other hand, Personal Software's justly famous "Visicalc" gets a full page, including general features of the program plus potential applications. And "Desktop/Plan," also from Personal Software, nets a detailed 5½-page listing.

Most descriptions lie comfortably between these extremes, and provide enough information for you to decide if you want to investigate the program further.

All in all, *Skarbeks Software Directory* is a valuable reference for serious Apple owners, and the planned updates (the first was scheduled for late November 1980) promise to be worth watching for.

—Reviewed by Don Wood

WHAT'S COMING UP

SOFTWARE

VisiCalc Enhancements for HP-85

VisiCalc Plus, software that combines the award-winning VisiCalc program with new enhancements, has been introduced for Hewlett-Packard's HP-85 personal computer.

With VisiCalc, data can be arranged and manipulated in tables. The program has proved to be a boon to users doing forecasting, budgeting and other business and technical applications.

The Plus in VisiCalc Plus stands for enhancements that are not available with VisiCalc on other microcomputers. The most important of the HP-85's extra powers are the graphics programs that let you turn VisiCalc tables into four-color graphics.

Line charts, bar charts, pie charts, and curve-fitting graphs are available along with versatile graphics features, such as six different styles of lines and hatchings.

VisiCalc Plus also features more than 20 functions not available on other VisiCalcs. These financial, statistical and math functions include internal rate of return, standard deviation and variance. A "Help" facility, which displays information about a key word typed by the user, also is part of VisiCalc Plus.

A 16-kilobyte memory module must be plugged into the HP-85 to run VisiCalc Plus. To run the graphics programs, an external plotter (HP 7225A or HP 9872A) and other enhancements are needed.

VisiCalc Plus will be sold in tape cartridge and disk form for $200 by computer stores and office equipment dealers who sell the HP-85. For more information contact Inquiries Manager, Hewlett-Packard Co., 1507 Page Mill Road, Palo Alto, CA 94304; (415) 857-1501. *Circle No. 125*

Heath Introduces New Software Line

The Heath Company is providing a new software line, Softstuff, designed for computer users who want quality documented programs to expand the capabilities of their computers for home and business use.

The first Softstuff applications programs include a full screen editor and an improved text formatter; a file transfer utility with on-line access to MircroNet Information Services available; education packages; entertainment program; and problem-solving small business software, including office management, word processing, telecommunications and office communications.

Among the initial Softstuff offerings will be an enhanced programming language, CBASIC. More languages are under development.

Initial Softstuff programs operate under the Heath Disk Operating Systems (HDOS). Programs operating under Digital Research's CP/M will also be released.

Many Softstuff programs have been developed by members of the Heath Users' Group, while others have been written by a team of Heath software experts. Each program has been tested and evaluated by Heath software engineers, according to a company spokesperson. Each product is fully documented.

The Softstuff line will be available through the Heathkit catalog, as well as at the 61 Heathkit Electronic Centers in the U.S. and Canada. Heath plans to offer Softstuff through other software retailers in the future.

For more details and price information on Softstuff programs write for a free catalog to: Heath Company, Dept. 350-520, Benton Harbor, MI 49022. In Canada, write: Heath Company, 1480 Dundas Hwy. East, Mississauga, Ontario, Canada L4X 2R7. Or pick up a copy at the nearest Heathkit Electronic Center. *Circle No. 123*

Tax Help for TRS-80 Owners

Tax/Saver, a highly interactive income tax program for the TRS-80, is being introduced by Micromatic Programming Company. This tax package helps the taxpayer prepare the return in the logical order used by professionals and according to the latest tax rules.

Tax/Saver leads you through the maze of the tax return and the regulations — step by step with several degrees of help available, the company said. People who have never filed a tax return before can understand and use Tax/Saver. The taxpayer can skip over parts of the program, verify input and correct mistakes.

Owning Tax/Saver is like having a personal tax accountant, the company said. If there is more than one way of doing the return, Tax/Saver lets you compare and choose the best result. With just one running of Tax/Saver, married couples can see the tax computed both ways — filing jointly and filing separately.

Tax/Saver compares itemized deductions to national averages; automatically computes certain limitations — on medical deductions and contributions; handles community property; checks for excess FICA; helps determine dependents.

The manual includes 1980 tax forms, information on special tax areas, lists of possible deductions, and a glossary of tax terms.

Tax/Saver completes the long and short forms, including: Itemized Deductions (Schedule A, Form 4684), Interest & Dividends (Schedule B) and Tax Calculation (Tables, both parts of Schedule TC).

Tax/Saver is tax deductible. It will lead out to income averaging and to maximum tax. It will also accept totals from all schedules and forms.

For TRS-80 16K, Level II on tape and TRS-80 32K, two disk drives on diskettes for $49. For more information contact Micromatic Programming Co., P.O. Box 158, Georgetown, CT 06829; 544-8777, (800) 223-5594, or in NY, call collect (212) 249-8890. *Circle No. 122.*

Desk-top Business Planner

Ohio Scientific developed a desk-top business planner named MDMS Planner. This software tool is designed for exclusive use on Ohio Scientific's line of personal and business computers.

WHAT'S COMING UP

The MDMS Planner is a tool for anyone who works with numbers. Financial analysts can use the planner to handle budget planning, capital budget planning, profit and loss projections, and cash flow planning. The accountant and/or controller can use it to prepare balance sheet projections, financial report preparation and make/buy analyses. Depending on the application, an accountant or financial analyst can easily make changes or comparisons using MDMS's "What If" recalculation feature. Production managers can handle job cost estimating while the personnel manager can perform manpower requirements planning. The sales manager can handle sales forecasting and comparing actual results with budgeted forecasts, the company said.

An important feature, according to the company, is MDMS Planner's compatibility with Ohio Scientific's MDMS data base manager. Any information, whether it be accounting data, personnel files, inventories or sales data can be stored in the data base and be accessed by the planner. This allows you to receive information in a timely and efficient manner.

MDMS Planner can handle complex business models by allowing you to enter up to 36 lines, 36 columns and 60 calculation rules. Additional flexibility is provided by full disk storage capability, automatic report generation and model consolidation (joining several models together), the company said.

According to Ohio Scientific MDMS Planner provides a variety of options in a menu format. Report specification options allow you to creat report headings, column headings, line descriptions and line numbers. Formatting options are available to create proper report forms. Once the proper report is created, it can be displayed to add planning values.

Calculation rules are next to be entered and stored. Once the planning values have been placed and the calculation rules entered, you can execute the Planner. Results will be displayed in report format and can be printed on hard copy output.

Unlimited model size, formatted report generation and English-like calculation rules are functions unique to MDMS Planner, the company said. Another feature is a plotting capability which allows you to plot results on a bar, cumulative bar or point graph.

Price is $99. For more information contact your local Ohio Scientific dealer or Ohio Scientific, 1333 S. Chillicothe Rd., Aurora, OH 44202; (800) 321-6850. *Circle No. 121*

Word Processing Software

National Microsoftware Producers, Inc., is offering VTS/80, a professional quality word processing software package that operates on CP/M (developed by Digital Research) compatible microcomputer.

VTS/80 is the first microcomputer word processing software system with documentation and features equivalent to the expensive and dedicated word processors such as DEC, Micom, NBI, Wang and Vydec, the company said.

VTS/80 is an integrated word processing system, designed for secretaries or temporary personnel who have no previous experience with computers or word processing systems.

The unique feature of the VTS/80 package is a replace-

ment set of keytops for the CRT keyboard. When these keytops are installed on a "dumb" CRT terminal the keyboard will have the appearance of a dedicated word processor. These keytops, which replace the existing keytops, are color coded by function and have the commands engraved on their side. In addition, the VTS/80 package consists of a self-standing, color-coded manual and the software diskette. The manual contains extensive graphics to aid the inexperienced user.

Versions are now available on both 5″ and 8″ diskettes for any 8080, 8085 or Z-80 microcomputer operating under the CP/M operating system. The keytops operate with over 90% of the commercially available CRT's.

Suggested retail price is $549. VTS/80 is sold through distributors and dealers only For more information contact National Microsoftware Producers, Inc., 3169 Fillmore St., San Francisco, CA 94123; (415) 346-7025. *Circle No. 127*

General Accounting Package and CP/M Operating System for TRS-80 Model II

Microed is offering a General Accounting Package consisting of a General Ledger, Accounts Payable, Accounts Receivable, and a complete CP/M operating system designed by Digital Research, for the TRS-80 Model II microcomputer. No other software is required.

The General Accounting Package uses double entry with user definable accounts. Seven levels of account classification are possible with up to four digit fields at each level. A special feature called the Operator Report Selector Generator will allow the generation of any type report to suit the business operation. The General Ledger programs allow entry of General Ledger transactions, prints General Journal, General Ledger summary and detail, Balance Sheet, Profit and Loss. The Accounts Receivable allows adding A/R invoices, printing Sales Journal, detail A/R report, Account Aging, add/update Cash Receipts with register, Cash Receipts Journal, and A/R billing. The Accounts Payable permits adding of A/P invoices, printing Purchase Journal, detail A/P report, Aging of Accounts, Check Writing, Check Printing, and Cash Disbursements Journal.

The CP/M operating system included has all of the standard CP/M programs plus Microed written utility programs. These utility programs provide the capability to format diskettes, copy diskettes, single drive operation, plus more. Both the CP/M documentation (manuals) and Microed documentation is included. The Microed CP/M for the TRS-80 Model II is capable of single or double density operation and senses the density of the diskette automatically.

The complete package is priced at $415. For more information contact Microed, 3910 Bandini St., San Diego, CA 92103; (714) 299-1125. *Circle No. 124*

Business Software for TRS-80

American Business Systems announced that its line of financial and business applications software packages are now available to users of Radio Shack TRS-80 computers.

WHAT'S COMING UP

These seven new ABS packages offer the same full-scale features and capabilities as the company's widely accepted software which runs on larger mini- and micro-computers. Now, individuals and small companies can have big machine capability on TRS-80 systems, the company said.

The packages include a complete series of financial systems, ranging from Accounts Payable and Receivable through Payroll, Order Entry, and Inventory Control to a fully automated General Ledger System, ABS said. The application systems currently available include Financial Modeling and Real Estate Sales Management.

The ABS packages run on a TRS-80 Model II with RS Cobol and are available through ABS's own dealers or directly from the company. They can be customized and maintained by the business owner's clerical staff. Complete documentation and training materials make it possible to be up and running in a matter of hours, the company said.

ABS systems were designed in response to specifications prepared by an advisory board of CPAs and meet or exceed all accounting requirements.

The General Ledger System's ability to generate and format financial reports lets it also act as a management information system for routinely monitoring the pulse of a business. Its Report Writer feature allows creation of any number of reports, including Profit and Loss and Balance Sheet statements, ABS said.

Among the many standard features of the Accounts Payable System are Vendor Checks and Aged Payables Report as well as a Cash Requirements Report. Accounts Receivable features Aged Receivables Reports and prepares customer statements. The Order Entry and Inventory Control System provides complete order processing, billing and inventory management support for the user. Payroll prepares payroll checks, Quarterly Earnings Reports and W-2's as well as a series of employee management reports.

The Financial Modeling System prepares complex projections and analyses. When data changes, the forecasts can be quickly and easily updated. Models can be created and modified with computational accuracy.

The Real Estate System gives agents and salesmen instant access to the agency's complete file of listings and comparables. Its five major sales support modules: 1) assess buyer purchasing power; 2) search files for listings that meet the buyer's requirements; 3) compute monthly payments for principal, interest and taxes; 4) project probable resale value; and 5) maintain a complete comparables file.

Minimum system requirements are a TRS-80 Model II with one disk drive and printer. Suggested price is $500 per package. For more information contact American Business Systems, Inc., 439 Littleton Rd., Westford, MA 01886; (617) 486-3509. *Circle No. 109*

Mailing List Software for CBM

CDS Corporation announced the release of Mail List for the Commodore CBM 16K and 32K computers with CBM 2040 disk drives and CBM or ASCII printers. Mail List runs with the new wide-screen 8032 and 8016 computers, the new Basic 4.0 and DOS 2.1, as well as the earlier versions.

WHAT'S COMING UP

Mail List is a user-oriented program which makes the preparation and organization of mailing list labels an easy and enjoyable task, the company said. Besides storing a large number (up to 1050) of records on a single disk, another feature of Mail List is that you can easily adjust the length of all fields. This means that personal users, as well as business users, will find that Mail List meets their needs, the company said.

Mailing labels can be sorted four ways: alphabetically, by Zip Code, active or inactive, and by a six-character utility field designated by the user.

The Mail List manual, which is over 30 pages, takes the novice (soon to be expert) through a step-by-step series of instructions in plain and simple English, the company said. The price is $95 and Mail List is available from your local computer dealer. For more information contact CDS Corp., 695 East Tenth North, Logan, UT 84321; (801) 753-6990.
Circle No. 110

PERIPHERALS

Tektronix Introduces Electrostatic Hard Copy for Video

For users needing quick and inexpensive hard copies of computer graphics, Tektronix Inc., has introduced the 4612 Electrostatic Hard Copy Unit for raster scan video signal (RS-170 compatible) copies.

The copy device is small and lightweight, and uses a dry carbon toner, which eliminates seepage problems occurring with liquid toner systems, and produces an image with consistent blackness and density.

The 4612 provides true archival copies as a result of the excellent storage qualities of dielectric paper, the company said. The paper has the look and feel of plain bond, permitting pen or pencil notations on the copy. Paper loading is quick and simple, and each roll provides about 540 hard copies. The cost per sheet is approximately 2¢, making total cost per copy, including toner, about 3¢. The 4612 units produce 8-1/2 × 11″ copies, with the actual image size occupying an approximate area of 7-1/2 × 5-3/4″.

The high resolution imaging provided by the 4612 is the result of a combination of factors. A total of 256 dot placements per inch horizontally and 171 placements vertically

combine with a high degree of dot overlap to create a smooth, aesthetically pleasing image. Each dot overlaps its neighbor by more than two-thirds horizontally, and nearly half vertically, producing a more uniform line.

High addressability is provided by a precision shaft encoder on the printing mechanism, which translates the position of the belt-mounted writing styli into an electronic signal, which the controlling electronics section uses to determine where to deposit the electrostatic charge on the paper. The charge on the paper attracts the dry toner, which contains carbon particles and wax. As the paper passes through the copier, a hot metal band melts the toner, making the image permanent on the paper.

The 4612 carries a unit list price of $4400, with OEM prices and discounts also available. For further information on the 4612 and other new members of this product line, contact the Marketing Communications Department, Mailing Station 63/635, Tektronix, Inc., P.O. Box 500, Beaverton, OR 97077; (503) 683-3411. *Circle No. 111*

TRS-80 Line Printer IV

Radio Shack has introduced the Line Printer IV, a proportionally spaced high-density dot-matrix printer for use with word-processing applications. The unit is also capable of producing either 80 or 132 fixed-space characters per eight-inch line for right justification or tabular information. Both upper and lower case letters are available in all three printing modes. Special characters available include the grave, braces, back slash and carat.

In addition, Line Printer IV provides true underlining, subscripts, superscripts, fixed or proportional print, enlarged characters, bold face and forward or reverse line feeds. Backspace control, up to 126 dot positions, simplifies boldface and overprinting.

Proportional characters vary in width from six dot columns (letter J) to 18 dot columns (letters M and W). A dot column is 0.00666 inches in width, or 150 dot columns per inch. Maximum line length is 1185 dot columns.

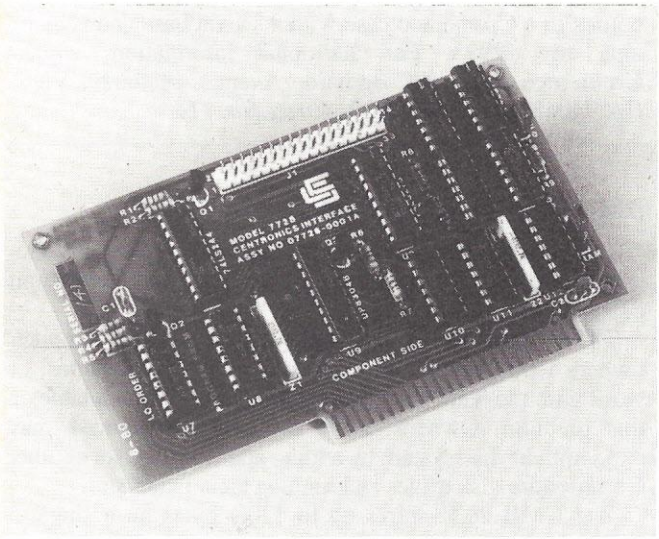
Print density is given as 10 or 16.7 mono-spaced characters per inch; 8.2 to 24.6 proportionally spaced characters per inch. Print speed is 50 characters per second, 22 lines per

minute. The printer size is 15 × 11 × 5″ and it weighs 12 pounds. The unit operates on 120 VAC, 60 Hz, 100 watts. The machine can be used with roll paper, pin-feed, 9-1/2″ fan-fold or single sheets with two carbons. A detachable roll paper holder is included.

The Radio Shack TRS-80 Line Printer IV, priced at $999, is available through Radio Shack stores and participating dealers and Radio Shack Computer Centers. For more information contact Radio Shack, 1800 One Tandy Center, Forth Worth, TX 76102; (817) 390-3272. *Circle No. 112*

Apple II — Centronics Interface

The Model 7728 Centronics Printer Interface gives Apple II users compatibility with the wide variety of printers using Centronics-type parallel interfaces. These printers include the Integral Data Paper Tiger, the Okidata Microline 80, the Microtek MT-80P, and the MPI 88T, as well as Centronics printers.



An on-board 256-byte ROM provides driver firmware and controls ASCII character output to the printer. The driver responds to standard Apple II printer commands for easy selection of command characters, characters per line, auto feed, and video echo. Users who choose to develop their own drivers may replace the standard ROMs with RAMs. A ROM/RAM jumper makes the necessary logic changes.

The 7728 may reside in any Apple II peripheral slot 1-7. It supports the interrupt daisy chain with arbitration logic including jumper-selectable IRQ generation, and provides DMA daisy chain pass-through. The printer interface includes an eight-bit data output bus, four status inputs, Data Strobe and Acknowledge handshake signals, and a printer Reset signal.

The 7728 is shipped fully assembled and tested, with complete documentation, for $119.95 list price. Cables for the different printers are available separately from CCS. The 7728 Centronics Printer Interface is warranted one year for parts and materials, and 90 days for labor. For more information contact California Computer Systems, 250 Caribbean Dr., Sunnyvale, CA 94086; (408) 734-5811. *Circle No. 113*

High Resolution Color Monitor

Cromemco announces the RGB-13, a new high resolution, RGB color monitor for use with Cromemco SDI graphics systems. The RGB-13 is ideal for displaying color or black-and-white images with Cromemco's SDI graphics interface, which provides up to 754 by 482 point resolution, the company said. The Cromemco graphics system and the RGB-13 are suited to applications in business, medical imaging, process control, industry, education, computer-aided instruction, science and a wide range of professional fields, the firm added. In addition, the system conforms to the NTSC standard RS-170 which makes it ideal for applications in the television industry.

The Cromemco RGB-13 monitor has a fine-pitch 13″ shadow mask and a high-precision delta-configuration electron gun. The monitor is self-converging and features internal magnetic shielding and an implosion protection band. A long-persistence phosphor guarantees a flicker-free screen. The RGB-13 monitor is an all-solid-state design with the exception of the CRT. The monitor (Model RGB-13) comes in a Cromemco case with a swivel base and is available for $2995. For additional information, contact Cromemco, Inc., 280 Bernardo Avenue, Mountain View, CA 94043, (415) 964-7400. *Circle No. 114*

Disk Drive from Commodore

Commodore International Ltd. announced the introduction of a new low-priced single 5 1/4-inch floppy disk unit designated the CBM 2031.

The CMB 2031 is designed for Commodore computer owners who want to put their data on floppy diskettes, or work with the wide range of computer programs available on that medium. Owners of the new single disk drive may expand their disk system by adding additional 2031s or other Commodore disk drives and running them in tandem.

The CMB 2031 stores up to 170K bytes on a single 5 1/4-inch floppy diskette and incorporates an IEEE 488 interface for use with Commodore's PET and CBM computer equipment. A serial-bus version, tentatively designated the 2031S will provide compatibility with Commodore's "VIC" color computer.

Disks written on the PET/CBM and VIC will be compatible with both serial and IEEE drives, subject to certain program limitations. The drive is based on the same technology used in Commodore's existing 2040/4040 dual disk drive unit and incorporates the latest disk operating system.

The CBM 2031 will retail for under $600 in both the IEEE and serial bus configurations. For more information contact Commodore Business Machines, Inc., 950 Rittenhouse Rd., Norristown, PA 19403; (215) 666-7950. *Circle No. 115*

Bar Code Reader for Apple

Advanced Business Technology, Inc. announced the Bar-Wand, a modified Hewlett-Packard HEDS 3000 reader, that plugs into the Apple II or III computer.

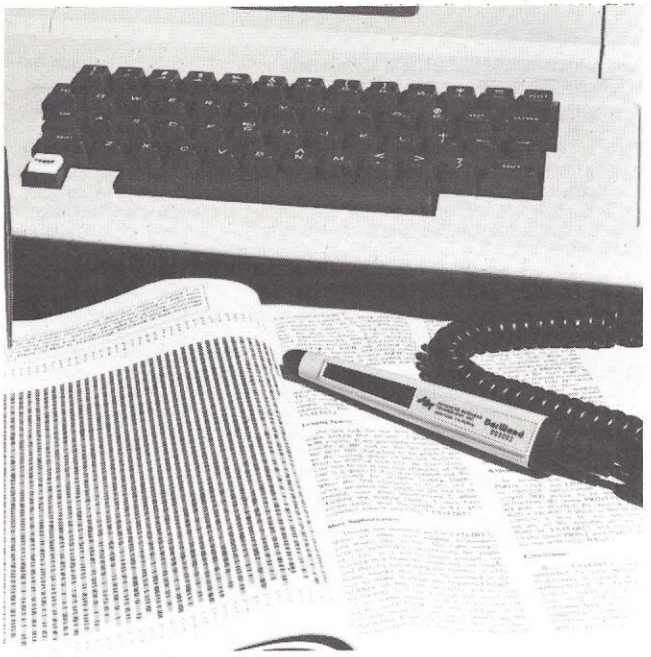
The familiar postage-stamp-sized pattern of printed bars

on most standardized supermarket products is "bar code". The BarWand allows this data to be presented to the computer with a significant reduction in labor and improvement in accuracy.

ABT has also developed software packages which are available in addition to the BarWand: a program to read Universal Product Code (UPC), and programs to print and read our own LabelCode and Applesoft programs in Paperbyte Code. The latter two are forms of bar code which can be printed with an inexpensive matrix printer. Other drivers will be announced at a later date.

With this new product, economical point-of-sale, inventory, security and production control systems are now feasible for operations ranging from small retail businesses to libraries to factories, the company said. Bar code may be reproduced by many typical office copiers and copies are readable by wand. Thus, bar code is also an inexpensive means of reproducing and distributing software.

The BarWand is a precision electro-optical device which reads programs and data when you guide it along a line of bar code. When bar code has been successfully entered, a scan tone will sound, indicating the last line of data was correctly read. The wand contains a light-emitting diode and a photosensor that detects changes in the light reflected from the material being scanned. The detected signal is digitized and translated by software into instructions the Apple understands. The push-to-read switch guards against wasted energy and an energy-efficient design lowers power consumption.



The suggested retailed price of $195 includes the BarWand warrantied for one year, and a demonstration diskette of the UPC, LabelCode and Paperbyte programs. These programs will be available separately at a later date on 5-1/4" media with detailed source listings and update material. For more information contact Advanced Business Technology, Inc., 12333 Saratoga-Sunnyvale Rd., Saratoga, CA 95070; (408) 446-2013. *Circle No. 116*

Interactive Video Display Terminal

The Ampex Dialogue 80 is a buffered editing terminal that operates in either conversational or block mode. The unit accentuates operator comfort with a non-glare display and non-glare key tops. The system, which operates quietly because it has been designed to function without a cooling fan, has a detached keyboard that can be positioned for operator comfort.

Display clarity is enhanced by brightness control and "half dot shift" features. Lower case characters have descenders for increased readability.

The unit has a keyboard with fast repeat-type keys that enable rapid data entry, and a numeric pad section. Separate keys control the movement of a switch-selectable cursor that can operate in block or underline, blinking or non-blinking modes.

A 25th display line (switch selectable on/off) allows you to determine the status of various operational modes and note detected errors. A New Line key performs carriage return and line feed functions.

Dialogue 80 has an RS-232C asynchronous interface, which operates up to 19.2 KB, half or full duplex, as well as a standard serial printer interface. A lock and unlock function that secures the keyboard from unauthorized use is standard.

The terminal offers scrolling as a standard feature in the conversational mode.

Dialogue 80 has a data format of 24 lines by 80 characters plus a top status line of 80 characters for a total of 2000 displayable positions on the 12-inch diagonal screen. The character format is a 6 by 8 dot matrix in a 7 by 10 field employing a half dot shift feature and lower case descenders to enhance clarity.

The terminal has reverse video, blink, blank, underline and half intensity features — all program or operator selectable. Protected fields appear at half intensity and cannot be changed when in the protect mode; only non-protected fields are transmitted, the company said.

Two 1920-character pages are provided as standard along with several editing features: erase, insert, and delete character and line functions. A third and fourth page of memory is optional.

The 128 displayable symbols include 96 ASCII characters, 21 control characters, and 11 characters to support line drawings. Program A and B keys in combination with the 10-key pad provide 20 user programmable functions: constants, screen formats or command sequences for the terminal and/or host computer.

The Ampex Dialogue 80 is priced at $1,149 in single quantities. Delivery is 30 days ARO. For more information contact Ampex Corp., 200 North Nash St., El Segundo, CA 90245; (213) 640-0150. *Circle No. 119*

SYSTEMS

S-100 Bus Computer System

Cromemco's new System Zero Computer is the lowest cost S-100 bus computer system available today, the company said. The System Zero is especially suited to dedicated applications in engineering, science, medicine and to a wide range of applications in professional fields such as education and business.

The System Zero is provided with Cromemco's powerful Z80A-based single card computer, one kilobyte of RAM memory and 3K Control Basic in ROM memory. An additional three slots on the S-100 bus are available for tailoring the system to individual requirements.

The basic System Zero is designed for ROM-based programs but the system can be expanded, by adding additional memory and I/O cards, to take full advantage of Cromemco floppy and/or hard disk systems, the company said.

A special version of the System Zero (System Zero/D) is available ready to use with floppy disks. It includes the Cromemco Z-80A single card computer, 64K of fast RAM and the 16FDC disk controller card. This controller card permits the use of high-capacity disk drives storing 390 kilobytes on each 5-inch diskette. The controller also has on-board a new resident disk operating system RDOS-2 which gives you the ability to read or write single-sided, double-sided, single-density, or double-density diskettes.

With this controller in the System Zero/D, you also get system diagnostics in the RDOS-2 program enabling a quick test of the computer-plus-drive system to see that the memory, controller and drives are functioning properly.

The System Zero/D is especially suited for operation with the Model DDF disk drive, a new dual disk drive which is housed in a cabinet matching that of the System Zero. The DDF uses 5-inch diskettes, either single-or double-sided and either single-or double-density.

Cromemco provides broad software support for the System Zero. Currently available software includes RPG II, Fortran, Cobol, 32K Structured Basic, 16K Basic, Lisp, Word Processing, Data Base Management, Business Application Software and sophisticated disk operating systems.

The basic system Zero (Model CSO) is available for $995. The System Zero/D (Model CSO/D) is available for $2995. The dual disk drive (Model DDF) is available for $1295. For additional information contact Cromemco, Inc., 280 Bernardo Ave., Mountain View, CA 94043; (415) 964-7400. *Circle No. 120*

New Business Computer

A new, expandable small business computer from Sharp Electronics, featuring a step-by-step programming aid, will be available nationwide in early 1981. The system, designated the Sharp YX-3200 Business Computer, includes a Central Processing Unit (CPU), high-resolution CRT (cathode ray tube) display with easy to read green characters, dual-drive floppy disks and an impact printer.

The desk-top system, designed with an expandable 32K Read-Only-Memory (ROM)/64K Random-Access-Memory (RAM), features the Automatic Program Generator which poses questions to the user that, when answered by a simple yes-or-no in most cases, actually designs the desired program, the company said. Once entered into the unit's Z-80 processor, a program can be stored indefinitely or used at the operator's convenience. The YX-3200 features an easy to understand extended BASIC language, the firm added.

Expandable, the YX-3200 can accommodate up to 72K ROM and 128K RAM. The Sharp 5¼-in. Floppy Disk Drives — dual-sided, double density — can store up to 285K bytes per diskette. The YX-3200 can accommodate a maximum of eight disk drives.

The high-resolution 12-in. CRT display offers upper- and lower-case characters on an 80 column by 24 line screen for a total of 1,920 characters. Another feature of the display is its capability to increase character size for group viewing or dramatic graphic purposes. When this feature is utilized,

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the CRT can contain up to 40 characters per column on a 15 line display for a total of 600 characters.

The system printer, a bidirectional, dot matrix 80-character-per-second unit offers an 80/132 column per line capability.

According to the company, price is under $6000. For more information contact Sharp Electronics, 10 Keystone Place, Paramus, NJ 07652; (201) 265-5600. *Circle No. 117*

Color Computer from Commodore

Commodore International Ltd. has introduced an expandable color computer system selling for under $300. The new computer, called VIC 20, offers a range of features and expansion capabilities.

The new VIC (Video Interface Computer) connects to any television set or monitor and provides 5K bytes of memory. Features include: color, sound, programmable function keys, memory expansion to 32K bytes, standard Pet BASIC, full size typewriter keyboard, external expansion ports, 22 characters by 23 line screen display, high resolution graphics, graphics character set, joystick/paddles/light-pen, and external plug-in memory and program cartridges.

The VIC 20 is designed so that you can begin using it immediately with plug-in program cartridges, and build your system gradually as your needs (or budget) allow.

VIC system peripherals will include a tape cassette unit, single floppy disk drive, printer — and a range of add-on accessories which tailor the system to a variety of special applications.

Commodore's new 2031 single disk drive unit will be provided in a serial bus version for use with the VIC, and at least one new Commodore printer will also be introduced.

The VIC's memory can be expanded using simple plug-in ROM cartridges. Special application programs and games will also be available in plug-in ROM form, as well as on tape and disk media.

Additional features like the computer's RS-232C interface capability makes it possible to use the VIC with telephone modem for accessing tele-

computing services or communicating with other computers. Special interface cartridges will also enable the VIC owner to use a wide variety of peripherals now on the market.

The VIC 20 will be sold for under $300 through Comodore's existing network of computer dealers. For more information contact Commodore Business Machines Inc., 950 Rittenhouse Road, Norristown, PA 19403; (215) 666-7950. *Circle No. 118*

COMPLEMENTS

Voice Entry Terminal for 48K Apple II

Scott Instruments is offering an enhancement to its line of VET/2 Voice Entry Terminals permitting its voice units to interface directly with any 48K Apple II computer. According to the company, the enhancement gives the microcomputer truly integrated speech recognition capability for the first time.

Measuring only 1-1/4″ high by 8″ wide by 10″ deep, the VET/2 plugs into any slot in the Apple II and is liked functionally to the keyboard for ease of use. The direct keyboard link allows the user to choose keyboard input or voice input at any time.

According to Brian Scott, president of the Denton, Texas-based firm, the new Apple peripheral allows the user to run Integer BASIC, AppleSoft and even machine-code programs by voice input with no modifications to the programs.

"Users wanting to run their word-processor programs with voice input can simply call the training routine, type the character, word or phrase they would like to enter by voice, say the word five times and return to the program. Thereafter, when the word is spoken the function is performed," Scott says.

The new VET/2 is the latest addition to the Scott line of voice entry terminals for microcmputers. A version announced early this year is available for interfacing with TRS-80 terminals.

The VET/2 is supplied with preprocessor, interface board, software (with demonstration programs), noise-cancelling headset microphone, and operator's manual. Price of the system is $895, FOB. Denton, TX. Delivery is quoted at 60 days, ARO. For more information contact Scott Instruments, 815 North Elm, Denton, TX, 76201; (817) 387-9514. *Circle No. 126*

Custom-Fitted Desk for North Star Computer

Furnwood Manufacturing announced a custom fitted L-return desk for the North Star Computer. It is available with the return on the right or left hand side. The desk is handcrafted and designed from real wood and is available with cable cut outs.

Built with easy accessibility for equipment maintenance, the desk has strength and quality to hold heavy printers and terminals. The computer

bay now comes vertical for space saving and easy access to the disk drives, but may on request be mounted horizontally, the company said.

The desk top offers a large working area of 27″ by 60″ with a return area of 18″ by 36″. It is built to a working height of 27″ for easy typing at the terminal, with a return height 25 1/2″.

Normally stained with an oil based Salem Maple color, then sealed and finished with quality mar-proof laquer, the color of finish can be changed to meet specific needs. Options available are drawers, additional disk storage compartment and adjustable feet. Custom compartments may be fitted to the desk for additional equipment to keep the work top clear, a company representative said.

Suggested list price is $560. For additional information please contact Furnwood Manufacturing Inc., 5664 S. W. Carman Drive, Lake Oswego, OR 97034; (503) 636-1991. *Circle No. 228*

Federal Funding Guide and Proposal Development Handbook for Educators

Radio Shack has announced the latest addition to their Educational Resource Series, a Federal Funding Guide and Proposal Development Handbook for Educators. The handbook is a resource guide for educators that explains how to locate external funding and how to write proposals.

Some special features of the handbook include indentification of the major sources of Federal funding and a listing of publications for monitoring Federal funding sources. It also outlines the essential elements of a proposal, offers suggestions for continuing and increasing external funding and contains an appendix of educational sources of funding information.

Specific formula programs under Title I, Title IVB and Migrant Education are discussed in detail, and competitive funding programs such as the National Institute of Education, Title IVC and Title II are explained.

In the section, "Writing the Proposal", a detailed explanation is given of the elements that make up a proposal. This includes: Needs Assessment, Objectives, Activities and Evaluation. A final chapter, entitled "Keeping the Pump Primed," offers suggestions for acquiring additional external funding once a proposal has been approved. The appendix has the addresses of all state education agencies to contact for assistance in obtaining funding information.

Radio Shack's Federal Funding Guide and Proposal Development Handbook for Educators is available from participating Radio Shack stores and dealers and Radio Shack computer Centers, nationwide. Priced at $2.50. For more information contact Radio Shack, 1800 One Tandy Center, Fort Worth, TX 76102; (817) 390-3272. *Circle No. 231*

Microcomputer Software Development Notebook

Atlantic Analysis Corporation announced publication of the "Microcomputer Software Development Notebook," second in a series of microcomputer based books intended for anyone who uses a microcomputer.

The businessman, microcomputer professional and the novice can all benefit from this notebook, the company said. The businessman can use it to develop his own systems as well as to evaluate professional proposals. The microcomputer professional can use it to assist and speed the development of software. Novice programmers can use this notebook as a text and a guide to achieve professional results.

Both as an education and reference tool, the notebook begins where Basic and Advanced Basic texts leave off. It does not teach a language but an organized approach to efficient software design, development documentation and delivery which will shorten the time required to produce even the most complex program, the company said.

Features include: A breakdown of the total development effort into manageable units that can be defined, developed and implemented; guidelines for: system specification preparation, testing and test plan development, program design and production, effective documentation preparation and delivery package preparation; down to earth discussion of proven programming techniques as they apply to Basic including: top down, structured, modular and data base; checklists, sample forms and file description layouts.

Cost per copy is $13.95 plus $1.35 for shipping. Virginia residents add 4% sales tax. For more information contact Atlantic Analysis Corp., 5 Koger Executive Center, Suite 219, Norfolk, VA 23502; (804) 461-1980. *Circle No.234*

Education Catalog for Apple, TRS-80 and TI 99/4

Charles Mann & Associates, Micro Software Division, has announced a new Education Catalog for educational applications programs for the Apple, TRS-80 and TI 99/4 computers. The catalog features a complete selection of programs from the firm's offerings which have proven useful to the school administrator and the teaching professional, the company said.

The catalog includes programs which can be used to develop customized teaching programs, programs teaching BASIC programming and

WHAT'S COMING UP

programs aimed at reducing the administrative burdens of school operation. The catalog featuring the firm's complete administrative package which assists the school system with grade reporting, class scheduling and record keeping. The teacher, the counselor and the administrator will find details on specific packages available to assist in improving the total educational experience, the company said.

The catalog is available free from any of CMA's 650 dealers world-wide. For more information contact Charles Mann & Associates, Micro Software Division, 7594 San Remo Trail, Yucca Valley, CA 92284; (714) 365-9718. *Circle No. 237*

Music Sweetener

Newtech Computer Systems Inc. announces the introduction of the Music Sweetener, a low-pass filter designed to improve the sound quality of Software Affair's Orchestra-80 and other commercial and homebrew digital-to-analog-converter music synthesizers that do not already incorporate a filter into their design.

The Music Sweetener attenuates the unwanted high frequency sampling noise four times better than a stereo system's treble control, and results in a much more distortion free, and

pleasing sound, the company said. It is similar to the four-pole 3.2KHZ low-pass filter incorporated into Newtech's Music Box for the Model I TRS-80, and is optimized for four-part music synthesis on most microcomputers.

the Music Sweetener is simply inserted between your music peripheral and your audio amplifier and is complete with instructions and AC adaptor power supply is $39.95 plus $2 for shipping and handling. For more information contact Newtech Computer Systems Inc., 230 Clinton St., Brooklyn, NY 11201; (212) 625-6220. *Circle No. 240*

Moving?

1. For FASTEST service attach old mailing label in space below.

Please allow 6 weeks for change to take effect

If mailing label is not available print your old name and address in this box

2. Print your NEW address here

NAME _____

ADDRESS _____

CITY _____ STATE ____ ZIP ____

3. Mail to: Personal Computing
50 Essex St.
Rochelle Park,
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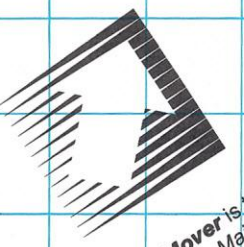
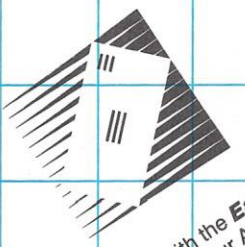


EasyMover is the first *Electronic Mail System* which combines the versatility of a word processor with the ability to move or transmit text files to another computer.



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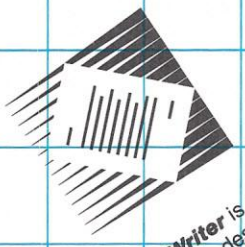
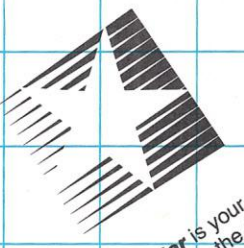
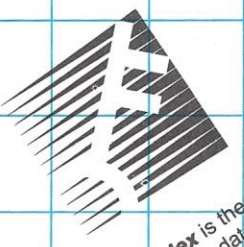


EasyWriter is a powerful word processor designed for the people who want the best.



TellStar is your computer window to the celestial objects as they appear at your home, or any location on the Earth you desire.



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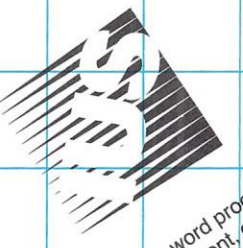

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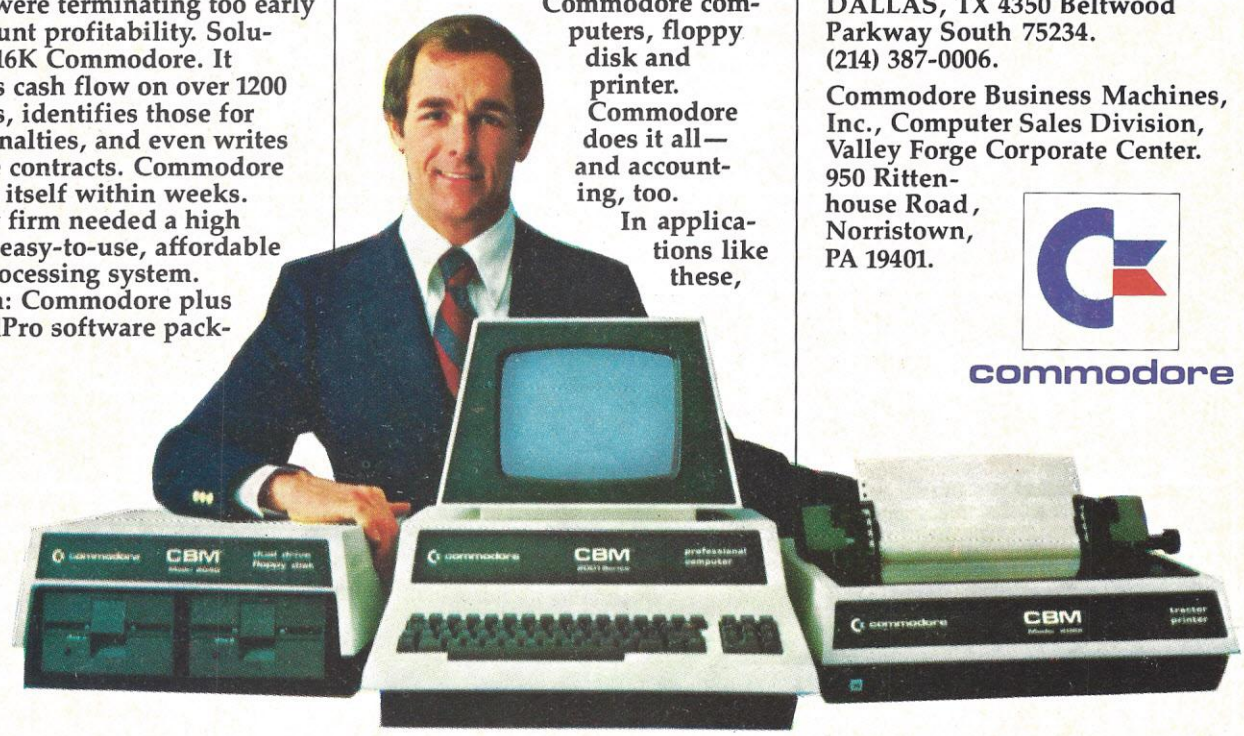

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